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Case study

Effects of nitinol on the ductile performance of ultra high ductility fibre reinforced cementitious composite

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ABSTRACT

The effects of nitinol on the ductile performance of fibre reinforced cementitious composites were investigated in this study. Nitinol fibres with two different diameters of 1 mm and 0.5 mm and nitinol powder of diameter 70 nm were used as micro-reinforcement and reactive powders respectively. The test results showed that nitinol powder accelerates the hydration of cement and promotes the nucleation of TiO_2 onto C-S-H leading to increased flexural and compressive strength. The nitinol fibre cementitious composite achieved ductilities of 7.3 % and 7.8 % with 1 mm and 0.5 mm nitinol fibres respectively at 28 days of curing. However, the nitinol fibres reinforced cementitious composites were unable to sustain ductilities after 90-days of curing losing nearly half of their ductile potency. On the other hand, nitinol powder achieved ductilities of 2.8 % and 5.6 % at 28 and 90 days of curing, respectively. Nitinol powder showed a potential as a ductile cementitious composite without the use of fibres.

1. Introduction

Conventional concrete is prone to cracking because it possesses low tensile and flexural strength [1]. After the formation of cracks, the capacity of the concrete to withstand further stresses is significantly reduced resulting in reduced strength, stiffness, and durability [2,3]. To prevent cracks and enhance the durability of concrete, short discontinuous steel fibres have been used as micro-reinforcement in cement mortars. Steel fibre reinforced cement composite can achieve improved post-crack flexural tensile capacities compared to conventional reinforced concrete [4]. However, cement composites made with steel fibres are relatively brittle with reduced tensile strain capacities even though higher compressive strengths may be achieved [4–6]. The use of more than 2 % steel fibres in the cement paste leads to balling effects which results in uneven dispersion of fibres in the cement paste [7]. Moreover, when steel fibre-cement paste is exposed to acidic environment, it leads to corrosion of the steel and deterioration of the cement matrix [2].

Due to the shortcoming with the use of steel fibres, polymeric fibres are used as alternative micro-reinforcement in the cement composite. The most widely used polymeric fibres are PVA, PP and PE [8–10]. PVA fibres possess poor cement particle retention capacity and poor bond with within the cement matrix [11]. PVA-cement paste decreases the ductility of the composite by adsorbing water molecules to form a weaker hydrogen bond with the hydration product instead of a stronger covalent bond [12–14]. Polypropylene fibres on the other hand, promotes micro crack initiation in the cement matrix because they have low elastic modulus compared to the cement paste [15]. The bond strength between PP fibres and the cement matrix is low and causes the enhancement of

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strain-softening and reduced tensile strain capacity of the cement composite [16]. PE fibres are three times less ductile compared to PP fibres [17] and though they have been extensively used in Ultra High Ductile Cementitious Composites, their ductility capacity is significantly reduced with compressive strengths higher than 150 MPa [18–20].

The increasing demand of structural use of concrete requires concrete to possess not only ductile behaviour but also the ability to absorb energy under extreme loading. Under cyclic loading, fibre reinforced cementitious composites members absorb more energy than standard reinforced concrete members [20,21]. Therefore, in order to extend the durability and the service life of concrete structures under extreme cyclic loading, it is vital to use as reinforcement a fibre that can undergo large deformation and retain whilst maintain a ductile behaviour. Polymeric fibres currently used as micro-reinforcement in cement matrix such as PVA, PP, and PE fibres undergo permanent deformation under cyclic loading and lose their capacity to absorb energy and unable to maintain their original form [20].

The type of fibre with the potential of self-centering after undergoing deformation whilst showing a ductile behaviour is Nitinol (Nickel-Titanium) alloy. Nitinol has two basic properties: shape memory effect and super-elasticity. The shape memory effect is the phenomenon whereby a material returns to its predetermined shape after unloading or heating [22] whereas the super-elasticity is the ability of a material to undergo large amount of inelastic deformation and recover its shape after loading [23]. These two unique properties are the result of reversible phase transformations of the crystalline structure of Nitinol – the stronger austenite stable in high temperatures and the relatively weaker martensitic phase stable in low temperature [22].

Nitinol has been extensively used as rebars or wires in concrete. Nitinol rebars have been used in the plastic hinge regions of RC beam-column elements to strengthen the weaker and vulnerable joint by dissipate significant amounts of energy with a little deformation and rotation during seismic conditions [23–25].

For instance, Alam et al. [23] performed a nonlinear dynamic time history analysis using ten earthquake records to determine the seismic performance of NiTi RC structure in terms of base shear and displacement. The results obtained confirmed the ductile response of RC structures utilizing NiTi as reinforcement. Similarly, Menna et al. [24] provided a comprehensive study on the use of superelastic NiTi alloy on improving the performance of RC beam- column joints and hybrid solutions involving fibre reinforced polymer (FRP). They showed that the reduction of the residual drift at the plastic hinge region related to NiTi superelasticity was limited due to significant slippage of the FRP bar inside the couplers. Moreover, Menna et al. [24] experimentally demonstrated that SMA anchorage can improve the restoring force characteristics of a column base and can prevent plastic deformation and damage in the column.

The shape memory effect of nitinol wires has been employed to restore structural concrete elements [26]. The results indicated the use of nitinol wires decreased the mid-span deflection and modified the tensile stresses in the tensile zone to be compressive stress to close tensile cracks. Moreover, stranded nitinol wires have been used for retrofitting in seismic zones, post-tensioning wires, [22,24, 27–29].

Despite the extensive use of nitinol bars and wires in structural concrete applications, there are very few studies on using short discontinuous randomly distributed nitinol fibres in cement composite [30]. Randomly distributed nitinol fibres provide three-dimensional reinforcement which act as resistance against flexural tensile stresses and enhance the ductility of the cement matrix [20]. The few studies that used short continuous randomly distributed fibres were able to achieve a measure of ductility and self-centering behaviour of cement composite but at a relatively lower compressive strength. Such compromise on compressive strength limits the application of fibre reinforced cementitious composites which are perceived to be expensive compared to standard reinforced concrete. The reduced compressive strength of cement composite produces larger concrete sections and heavy concrete members making their use in design uneconomical.

This study investigates the ductility performance of nitinol- ultra high ductility cementitious composite at compressive strength of above 120 MPa. The flexural strength, modulus of rupture, deflection, flexural strain capacity, flexural toughness as well as the equivalent flexural strength ratio are investigated.

2. Materials and experimental program

2.1. Materials

The materials and composition of the mix design followed that proposed Yu et al. [31] because at the time of this study, they were the only study that achieved both compressive strength above 120 MPa and ductility above 8 %. Meanwhile, slight modifications were

Table 1
Chemical composition of cement, GGBS and Silica sand.

Composite	OPC	GGBS	Silica Sand
SiO_2	21.03	39.66	96.62
CaO	63.63	34.2	0.57
$A_{l2}O_3$	4.73	12.94	1.54
Fe_2O_3	2.93	1.58	1.02
MgO	2.67	6.94	0.57
Na_2O	0.3	0.2	–
K_2O	0.65	1.44	–
SO_3	3	0.72	–
L.O.I	3.84	1.2	<0.5

made to the mix design to reflect the objective of this study. For instance, the weight of the superplastisizer of 30 kg/m^3 was used instead of 25 kg/m^3.

The cement used is Ordinary Portland cement type I. Grade S105 Ground Granulated Blast Furnace Slag (GGBS) of particle size 1–100 µm was used as a secondary binder to replace cement. The GGBS was used in the cement paste due to its pozzolanic nature at room temperature and its ability to reduce the porosity of the cement matrix [32–34]. In order to maximise the calcium-silicate-hydrate content of the cement matrix silica fume (SF) of particle size 0.1–1 µm was used as secondary cementitious material. Fine silica sand of maximum size 180 µm and an average size of 135 µm as used as fine aggregate. A high range water-reducing polycarboxylic-based admixture, MasterGlenium 315C obtained from BASF was used as a superplasticizer.

The chemical compositions of the cement, SF, GGBS and silica sand are as shown in Table 1. Two nitinol fibres of different aspect ratios were used since previous studies posited that fibre aspect ratio affects the ductility of cementitious composite [35,36]. The diameters of the nitinol fibres were 1 mm and 0.5 mm (see Fig. 1b and c) whereas the size of the nitinol powder particles was 0.07 µm (see Fig. 6a) were used as separate nano reinforcement in the cementitious composite. The mechanical composition of the nitinol fibres and nitinol powder are explained in Table 2.

Moreover, nitinol fibres of diameter 1.0 mm and 0.5 mm as well as nitinol powder were used as micro and nano-reinoforcements respectively. The mix designs are identified by symbols namely the control mix without fibres (NT00), the mix with 0.5 mm diameter nitinol fibres (NT0.5), the mix with 1 mm diameter nitinol fibres, and the mix with nitinol powder (NTpowder). The details of the design mix composition are shown in Table 3.

A mixing sequence was developed to ensure consistent mixture. All dry materials, (i.e., cement, GGBS and sand were mixed with a high-speed mixer of 140 rpm for approximately 1 min to achieve homogeneous dry mix. Then, water and superplasticiser (HRWR) were gradually added and mixed for approximately 5 min with a speed of 140 rpm. The speed was increased to 420 rpm for additional 8 min. After that the mix was put into moulds and compacted using mechanical vibrator. The specimens were kept in the moulds at room temperature and demoulded after 24 h. Each mould was clearly marked and cured in water for 28 days.

2.2. Experimental methods

The flow ability of the mixture was conducted in accordance BS EN 12350-8 [37]. In this process, the cementitious mixture was filled into a 100 mm conical frustum shaped specimen in three layers placed on a flow table. The mixture was then firmly compacted with 25 strokes of a standard 16 mm diameter and 600 mm long round tipped rod. The conical frustum was carefully removed, and the mix is dropped 15 times within 15 s. Two diameters perpendicular to each other are measured. The test was repeated for two more times in order to determine the mean of the three tests.

The prismatic specimens were subjected to the flexural strength test in accordance with BS EN 12390-5 [38]. The test was conducted at a loading rate of 0.2 mm/min on a standard 40 mm x 40 mm x 160 mm prisms were used for the test on three samples.

Each half of each 40 mm x 40 mm x 160 mm prism from the three-point bend test was tested for compressive strength in accordance with BS EN 12390-3 [39]. Each half of the standard prism was subjected to compressive stress at a rate of 250 ± 50 kPa/s on a 40 mm x 40 mm area on the two-smooth surfaces in a Universal Hydraulic Testing Machine (UTM) of capacity 2500 K N.

A dog-bone shaped specimen (Fig. 2) was used to perform the direct tensile test of hardened cement mixture in accordance with the JSCE [40] standards. Threaded steel rods were placed at the sides and bottom of the specimen at length of 225 mm on each side and a wooden rod of 50 mm diameter and 50 mm length was connected to the steel in the middle for better alignment and to reduce bending stress [34]. The ends of the specimen were further reinforced with aluminum mesh to ensure failure occurs at the midspan - weakest portion of the specimen. The dog-bone-shaped specimen was mounted in a 2500 kN capacity UTM machine through the two 19 mm threaded rods.

The test was conducted in a displacement controlled mode using two external LVDTs at both front and rear of the specimen at a constant rate of 0.001 mm/s until the peak load is obtained and then gradually increased up to a maximum speed of 0.01 mm/s. Three specimens were tested in each experiment.

2.2.1. X-ray diffraction (XRD) test

The micro-structure of the cementitious composite was analysed through X-ray Diffraction (XRD). To prepare the cementitious

Fig. 1. a – Nitinol Powder Fig 1b – 1 mm Nitinol Fibre Fig 1c – 0.5 mm Nitinol Fibre.

Table 2
Mechanical and physical properties of nitinol.

Property	Fibre	Powder
Density (g/ m^3)	6.45	6.45
Diameter (μm)	500/1000	0.07
Elastic Modulus (GPa)	41	41
Tensile Strength (MPa)	895	895
Ductility (%)	38	38
Shape	Round	spherical
Purity (%)	99.9	99.9

Table 3
Composition of Nitinol Cementitious Mixture (by Weight kg/m^3).

Mixture ID	Cement	GGBS	SF	Sand	Water	HRWR	NiTi Fibre	NiTi Powder
NT00	820	750	150	500	230	30	–	–
NT0.5	800	750	150	500	230	30	20	–
NT1.0	800	750	150	500	230	30	20	–
NTPowder	800	750	150	500	230	30	–	20

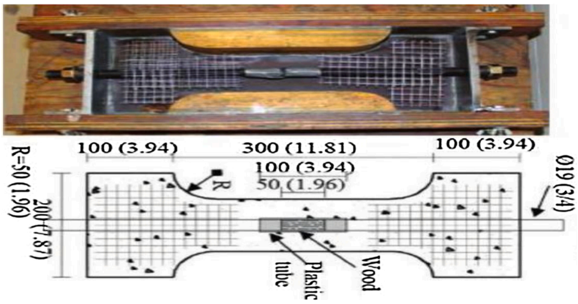


Fig. 2. Tensile test (dog-bone-shaped) specimen [41].

composite for the XRD test, specimens cured at 28 days were crushed into pieces and ground in a mortar by means of a pestle until it turned into powder. A sample of the cementitious composite powder was put in the sample holder and placed into the Siemens D500 X-ray Diffractometer. The X-ray diffractograms were recorded from each powdered sample over a 2θ angle range from 10° to 70° using Fe filtered Co Kα radiation. Crystal phases in the cementitious matrix were identified using the Joint Committee on Powder Diffraction Standard powder data file.

2.2.2. Scanning electron microscopy (SEM) test

The morphology of the crystal phases in the cementitious composite was analyzed by means of Scanning Electron Microscopy (SEM) test. The test involved the preparation of the samples and bonding to the microscope slides. First, the samples were cold cut into 50 × 20 mm size to fit a microscope slide. The samples were then dried to remove excess water resulting from the cold-cutting. After that air bubbles were removed by sucking air out of the samples and impregnating epoxy resin into the samples by in the impregnation chamber (see Fig. 3a).

a – Removing air bubbles from sample b- Samples embedded in resin

Fig. 3. a – Removing air bubbles from sample Fig 3b- Samples embedded in resin.

The resin was made of two parts epoxy resin part A and two parts epoxy resin part B- hardener obtained from Logitech Limited in the ratio of 3:1. After 24 h, the samples were fully embedded in the hardened resin (see Fig. 3b) and cold-cut to remove excess resin and prepare the surface for bonding to the microscope slides. One face of the samples was lapped. Then after, the microscope slides were lapped to ensure even thickness. The lapped sample face was then bonded to the microscope slide using the mixture of the epoxy resins used in the impregnation. The unlapped faces of the samples were cold cut to 500 μm thickness. Then the unlapped face of the samples were lapped in the lapping machine (see Fig. 4) so that the surfaces could reflected light. The bonded samples were then put into the SEM test machine and adjusted at different sides to provide views of various sites of the test samples.

3. Results

3.1. Flowability test

The influence of nitinol (both fibre and powder) on the flowability of nitinol reinforced cementitious composite can be determined by the flowability test as manifested in Table 4 and Fig. 5. It can be seen that the average flowability for NT00, NT0.5, NT1.0 and NTpowder are 161 mm, 123 mm, 142 mm and 161 mm, respectively. The results show that, incorporating nitinol fibres in the cementitious composite has profound effects on its flowability. The NT00 (without nitinol) and NTpowder, showed higher flowabilities since without fibres there was no shear resistance against flow [42].

Even though the same volume of fibres was used, NT0.5 showed lower flowability (i.e., 15.5 % decrease) over NT1.0. because reducing the diameter of the fibre by half results in 4 times increase in the number of fibres in a given volume. Thus, with the same weight, density and length, the number of individual fibres in a 0.5 mm nitinol fibre will be 4 times higher than that of a 1 mm diameter nitinol fibre due to higher surface area and more shear resistance.

3.2. Compressive test

The results from the test (see Table 5 and Fig. 6) demonstrate that the average 28-day compressive strength of 136.2 MPa and an average 90-day compressive strength of 144.8 MPa were achieved with NTpowder. The control sample, NT00 (i.e., without nitinol fibre or powder) achieved a 28-day compressive strength of 115.7 MPa whereas NT0.5 achieved a compressive strength of 110.7 MPa. It can be seen that inclusion of 2 % 0.5 mm and 1 mm diameter nitinol fibre reduced the compressive strength by 4.3 % and 41.3 % respectively. This may be due to the lack of homogeneity of fibre dispersion in the cementitious composite. Because compressive strength is highly influenced by the homogeneity [43], congestion of fibres may cause balling effect and weak bonding of fibres with the cementitious composite, resulting in reduced compressive strength [44]. With the same fibre volume and length, the compressive strength of NT05 was 1.6 times higher than NT1.0 (Table 5). This suggests that the compressive strength of nitinol fibre reinforced cementitious composite may be sensitive to its fibre aspect ratio.

On the other hand, the compressive strength of NTpowder was 17.7 % higher than that of NT00. The difference may be attributed to the filling effect of nitinol powder. Due to the larger specific area of nitinol powder compared to nitinol fibres, the powder is able to fill extra pores in the cementitious composite, resulting in a denser mixture. The reduction of pores and promoting of denser composite improve the compressive strength [45].

Furthermore, Fig. 6 demonstrates that the 90-day compressive strength of all composites was generally higher than that of the 28-day compressive strength (i.e., NT00, NT05, NT1.0 and NTpowder increased by 14.6 %, 22 %, 5.4 %, 6.3 % respectively). The significant increase in the 90-day compressive strength denotes the continuous hydration of the cement due to low water-to-binder ratio compared to ordinary concrete [4].

3.3. Flexural test

The effects of the nitinol fibre and powder on the flexural properties of cementitious composite are presented in Table 6. It can be

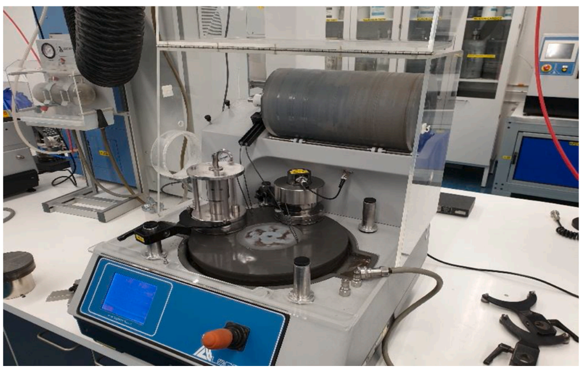


Fig. 4. – Lapping the face of the specimen.

Table 4
Results of Flowability Test of Nitinol Reinforced Cementitious composite.

Mixture ID	Sample1 (mm)	Sample2 (mm)	Sample 3 (mm)	Average (mm)	STD*
NT00	161	161	162	161	0.58
NT0.5	123	124	122	123	1.26
NT1.0	144	142	141	142	1.26
NTpowder	162	161	161	161	0.58

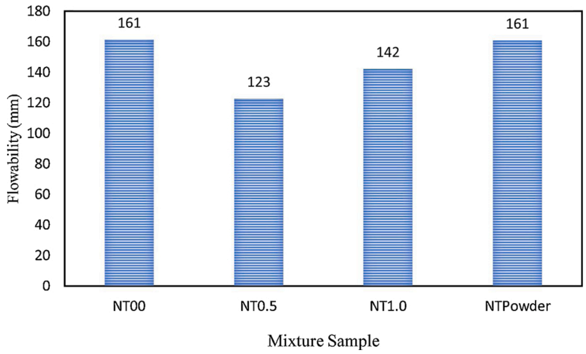


Fig. 5. Effects of nitinol on the flowability of nitinol reinforced cementitious composite.

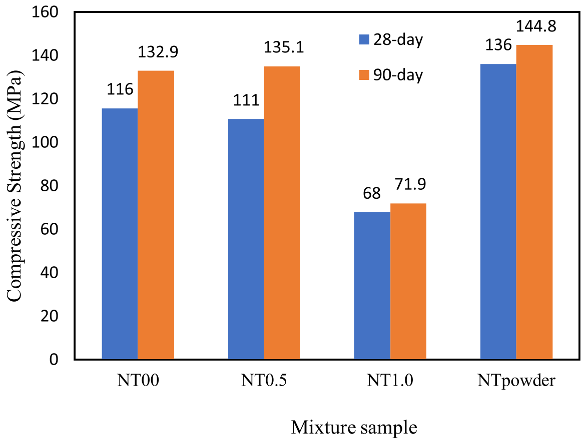


Fig. 6. Effects of nitinol on the flowability of nitinol reinforced cementitious composite.

Table 5
Compressive Strength of Nitinol Reinforced Cementitious Composite.

	28-day Compressive Strength (MPa)		90-day Compressive Strength (MPa)	
sss	Av. Comp. Str.	STD*	Av. Comp. Str.	STD*
NT00	115.7	8.0	132.9	8.0
NT0.5	110.7	3.6	135.1	11.3
NT1.0	67.9	6.7	71.9	3.9
NTpowder	136.2	5.4	144.8	11.2

observed that, incorporating nitinol (both fibres and powder) in the cementitious composite resulted in increase in the flexural strength. Despite the addition of nitinol powder, nitinol fibres have been found to significantly improve the flexural strength of cementitious composite, which is in line with previous studies [46–48].

According to Hussein and Amleh [49], the reason for the enhanced flexural performance is that, after cracking of the matrix, the fibres in cementitious composites carry the residual load until they lose their interfacial bond between them and the matrix. This prevents sudden failure and results in an increased load carrying capacity.

Table 6
Flexural Properties of Nitinol Reinforced Cementitious Composite.

	28-Day Flexural Properties				90-Day Flexural Properties			
Mixture ID	Max. Load (KN)	Deflection (mm)	Stress (MPa)	Strain (%)	Max. Load (KN)	Deflection (mm)	Stress (MPa)	Strain (%)
NT00	6.61	24.00	21.80	0.23	5.81	25.33	12.81	0.24
NT0.5	8.31	21.00	31.14	0.20	10.16	38.00	38.10	0.36
NT1.0	6.86	25.67	26.11	0.23	10.01	32.67	37.55	0.31
NTpowder	9.56	27.33	35.85	0.26	11.81	51.00	44.29	0.48

As shown in Fig. 7a–d, the flexural properties of nitinol reinforced cementitious composite depend not only on the type of fibre but also the fibre aspect ratio and the matrix-bond characteristics of the fibres. Higher fibre aspect ratio has improved flexural properties compared to lower fibre aspect ratio. For instance, compared to NT1.0, the flexural strength of NT0.5 increased by 19.3 % and 1.4 % for 28 and 90-day tests, respectively. Furthermore (see Table 6), NTpowder mix with a high specific area achieved the highest flexural strengths of 27.33 MPa and 44.29 MPa at 28 and 90 days, respectively. The results agree with Yazici et al., [50] which indicates that fibre aspect ratio or specific area of fibres are critical to enhancing the flexural strength of fibre reinforced cementitious composite.

Furthermore, incorporating nitinol in the composite had little impact on the midspan deflection (see Fig. 7a–d). The deflections achieved by the samples are 24 mm, 21 mm, 25.67 mm and 27.33 mm for NT00, NT0.5, NT1.0 and NTpowder respectively. Compared to NT00, NT1.0 and NTpowder achieved an increase in deflection of 7 % and 14 % respectively whereas NT0.5 achieved a 12.5 % decrease in deflection. The relative decrease in deflection for NT0.5 is expected due to its relatively low flexural strain capacity at 28 days of curing. Since deflection is directly proportional to the flexural strain capacity [51], a decrease in the flexural strain capacity results in a corresponding decrease in the deflection.

Findings by Lepech and Li [14] and Xu et al. [52] that hydration has signifcant impact on flexural deflection of fibre reinforced cementitious composites can be confirmed from the results of the 28-day and 90-day flexural deflection. According to Table 6, the 90-day flexural deflection were higher than the 28-day flexural deflection by 5 %, 81 %, 27 % and 87 % for NT00, NT0.5, NT1.0 and NTpowder respectively.

NTpowder showed higher flexural deflection as well as deflection-hardeming behaviour compared to all other mixture composites (see Table 6 and Fig. 7d). This is because, like strain-hardening behaviour, deflection-hardening depends to a larger extent on the fibre-matrix bond strength and reduced pore formation in the matrix [4,53]. Nitinol powder has higher specific area and serves as filler in the matrix. Giovanni and Giovanni [54], reported that, higher specific area of reactive powders promotes. Moreover, the filling ability

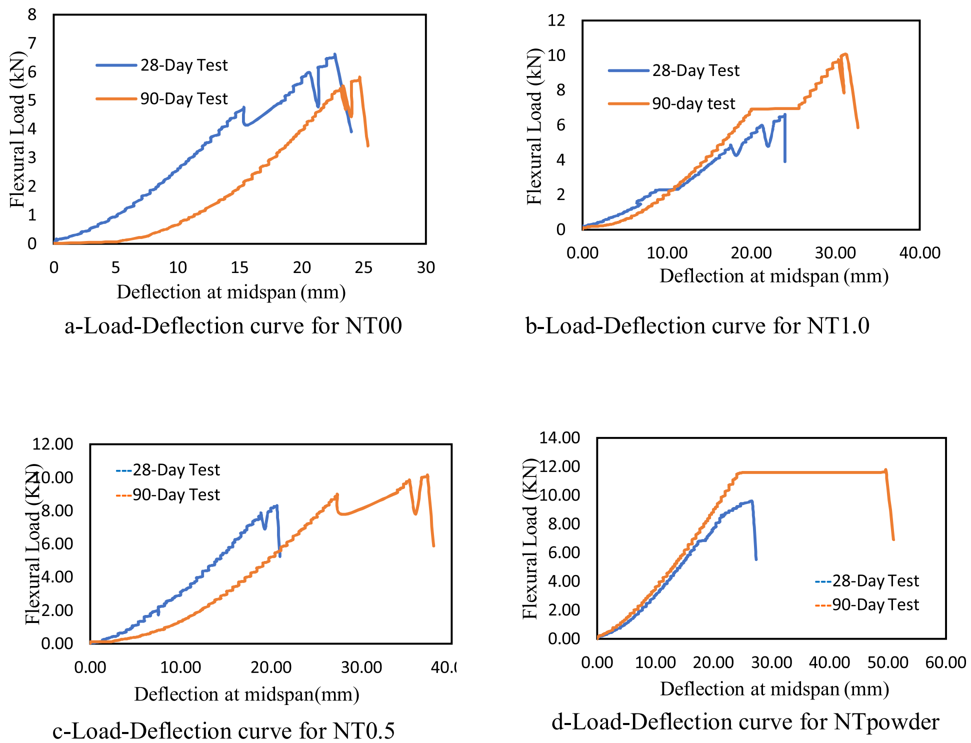


Fig. 7. a - Load-Deflection curve for NT00 Fig. 7b-Load-Deflection curve for NT1.0. Fig. 7c -Load-Deflection curve for NT0.5. Fig. 7d -Load-Deflection curve for NTpowder.

of the nitinol powder in the matrix promotes dense and compact composite and also reduce the pores in the matrix [55].

Curing age affected the flexural strain capacities of all mixture samples which is consistent with the results achieved by Wei [56] and Domski [57]. According to Table 6 and Fig. 8a–d, the flexural strain capacities at 28 days of curing increased compared to that of 90 days of curing. The flexural strain capacities 28 days of curing compared to 90 days of curing increased by 4.3 %, 35 %, 80 %, 85 % for NT00, NT1.0, NT0.5 and NTpowder respectively. Compared to NT00, the 28-day flexural strain capacities of NTpowder increased by 13 % whereas NT0.5 achieved a reduction of 13 %. However, there was no significant change in the flexural strain capacity at 28 days of curing.

Moreover, at 90 days of curing, the flexural strain capacity of NTpowder was double that of the control (NT00) whereas NT1.0 and NT0.5 experienced increases of 50 % and 29.2 % compared to the NT00.

These results seem to suggest that, apart from curing age, fibre aspect aspect ratio or surface area of either fibres or reactive powders may be important factors which influence the flexural strain capacities of fibre reinforced cementitious composites. Hamdy et al. (2016) achieved similar results and concluded that higher fibre aspect ratio improves the flexural properties of fibre reinforced cementitious composites.

Furthermore, the cementitious composites with nitinol fibres and nitinol powder showed flexural strain-hardening behaviour. For example NT1.0 showed flexural strain-hardening behaviour between strain values of 0.19 % and 0.24 % strains whereas NTpowder showed significant flexural strain-hardening behaviour between 0.23 % and 0.47 % strains after attaining the ultimate flexural strength of 43.54 MPa. That flexural strain-hardening was achieved with nitinol powder cementitious composite gives an indication that, strain-hardening may not only be caused by slipage of fibres [58] but also slipage of metallic powdered particles or formation of near-metallic bonds in the cementitious composite.

3.4. Tensile test

As expected, the results of the 90 day direct tensile test of all mixtures were higher than the 28-day tests (see Table 7 and Fig. 9a &b) which confirms similar results achieved by Shajil et al., [20]; Kim et al., [59] and Fakharifar [60].

Compared to the control (i.e., NT00), the 90-day direct tensile strength of NT1.0 and NT0.5 increased by 1.89 and 1.62 times respectively whereas the NTpowder showed significant change. Moreover, compared to the 28-day strengths, the 90-day tensile strength of NT00, NT1.0, NT0.5 and NTpowder increased by 0.98 %, 141.94 %, 32.26 % and 80.65 % respectively.

On the other hand, except for NT00 and NT0.5, the tensile strain capacity of all mixtures decreased with increasing curing age. From Table 7, the 28 day direct tensile strain capacity increased by 2.7 %, 6.9 % for NT1.0 and NTpowder respectively and decreased by 57.14 % and 8.9 % for NT00 and NT0.5 after 90-days of curing.

The constitutive stress-strain behaviour of Nitinol fibre and Nitinol Powder reinforced cementitious composite under tensile loading is shown in Fig. 9a and b. From the 28-day stress-strain curve (Fig. 9a) it is observed that for the control mix (NT00), the stress

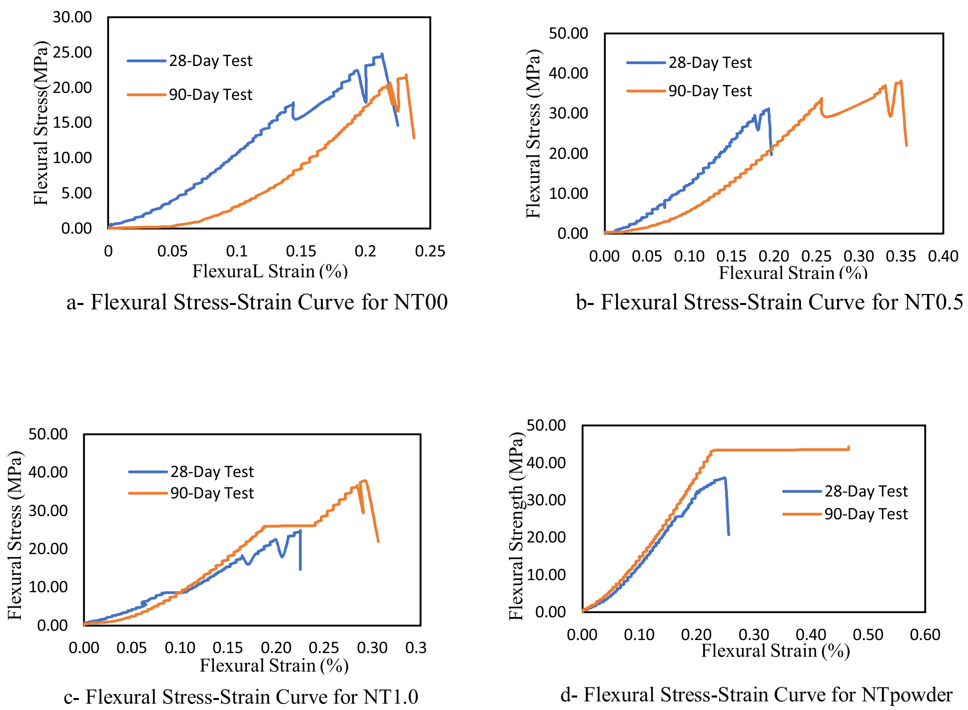
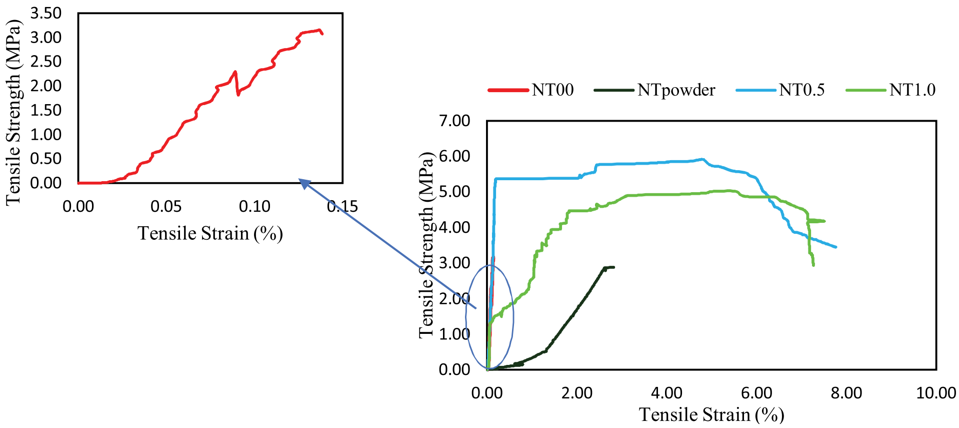


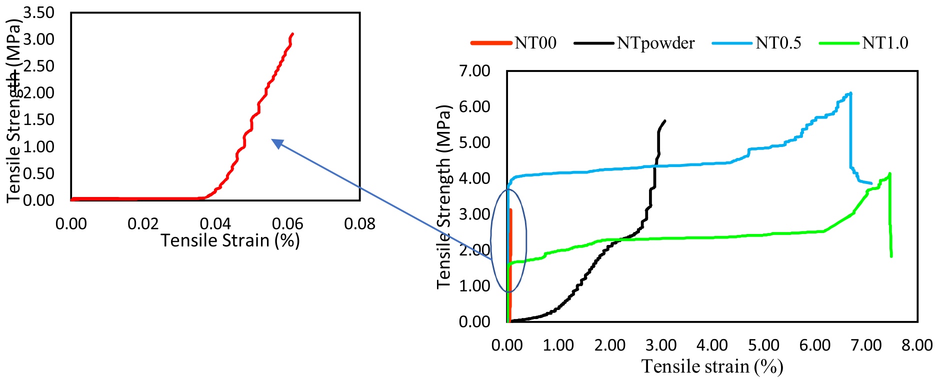
Fig. 8. a - Flexural Stress-Strain Curve for NT00. Fig. 8b - Flexural Stress-Strain Curve for NT0.5. Fig. 8c - Flexural Stress-Strain Curve for NT1.0. Fig. 8d - Flexural Stress-Strain Curve for NTpowder.

Table 7
Tensile Behaviour of Nitinol Reinforced Cementitious Composite.

	28-Day Strength		90 -Day Strength	
Mixture ID	Max Tensile Strength (MPa)	Strain (%)	Max Tensile Strength (MPa)	Strain (%)
NT00	3.07	0.14	3.10	0.06
NT1.0	5.8	7.30	4.1	7.5
NT0.5	5.0	7.8	6.34	7.1
NTpowder	2.90	2.80	5.6	3.1



a-28-Day direct tensile stress-strain relationship of nitinol reinforced cementitious composite



b- 90-Day direct tensile stress-strain relationship of nitinol reinforced cementitious composite

Fig. 9. a -28-Day direct tensile stress-strain relationship of nitinol reinforced cementitious composite. Fig. 9b - 90-Day direct tensile stress-strain relationship of nitinol reinforced cementitious composite.

increased with increase in strain linearly right up to the yield point. Afterward the stress continued to increase with a corresponding increase in strain before its sudden failure. The ultimate strain reached is 0.14 %. in contrast. Under tension, NTpowder exhibited pseudo strain-hardening behaviour and non-linear relationship up to 0.5 % strain. The pseudo-hardening behaviour is due to slipping of the nitinol ions in the composite under tension [5,6]. Beyond the stress of 1.3 MPa, a sharp rise in tensile stress was accompanied by a slower increase in the tensile strain. The ultimate strain was achieved at 2.8 % at an ultimate stress of 2.9 MPa. Considering the 28-day behaviour of NT0.5 and NT1.0 under tension, both composite exhibited linear relationship between the stress and strain. However, the sharp increase in stress was accompanied by an insignificant increase in strain. NT0.5 achieved a yield stress of 5.2 MPa whereas NT1.0 achieved 1.4 MPa indicating that fibre aspect ratio may have influence on its yield strength. After the yield, both NT0.5

and NT1.0 exhibit strain-hardening behaviour between 0.2%–7.27% strain and achieved ultimate strengths of 5.8 MPa and 5.0 MPa, respectively. The ductile behaviour at fracture for NT0.5 and NT1.0 are similar suggesting that fibre aspect ratio may not be a significant factor in determining the ultimate strain of fibre reinforced cementitious composite.

On the other hand, the 90-day stress-strain of the composites showed significant change in behaviour compared to the 28-day stress-strain curve. For instance, the fracture strain of NT00 decreased from 0.14 % to 0.06 % suggesting that the NT00 became more brittle with age and with increase in compressive strength. This is so because as reported by Wille et al. [4] Duthinh and Starnes [5] and Naaman and Wille [6], increase in compressive strength of FRC is usually accompanied by reduced ductility. However, this was not the case with NTpowder which achieved increased strength from 2.8 MPa to 5.6 MPa and increase in ductility from 2.9 % to 3.1 %. NT0.5 and NT1.0 achieved increased strengths after 90days of curing compared to 28-days of curing. Moreover, NT0.5 and NT1.0 exhibited improved strain hardening behaviour from 0.07 % strain through to at least 6.56 % strain (see Fig. 9b). Furthermore, whereas the ultimate strength achieved 28-day in NT0.5 and NT1.0 was accompanied by strain-softening their ultimate strength were achieved at fracture.

Thus NT00, NT0.5 lost their tensile strain capacities between 28 and 90 days of curing. Lepech and Li, [14] achieved similar results with PVA fibres instead of nitinol fibres. They concluded that, the tensile strain of PVA fibre reinforced cementitious decreased with increasing curing age due to weaker fibre-matrix bond. They also attributed the decline in tensile strain with curing age to the hydrophilic nature of PVA fibres which absorb water molecules onto its surface and compete with the water meant for hydration. According to Feng et al. [61], nitinol alloy is hydrophilic and like PVA fibres has the potential of absorbing water molecules onto its surface and impeding the hydration process leading weaker fibre-matrix bond.

However, the decrease in tensile strain for NT0.5 was not significant to conclude that curing age has effect on the tensile strain of nitinol- fibre reinforced cementitious composite.

Both NT1.0 and NTpowder were not affected by the age of curing.

Table 7 shows that, the 90-day tensile strain capacity doubled over the 28-day tensile strain value. This suggests that nitinol powder may act as a pozzolanic agent, capable of improving the hydration process. Ma et al. [62] showed that, Titanium Dioxide ($Ti0_2$), an oxidised product of NiTi is responsible for improving the tensile properties of $Ti0_2$-incorporated cementitious composite. Thus, it seems that the heat of hydration causes the titanium in the nitinol powder to oxidize to form $Ti0_2$ which further enhances the hydration rate and improves the tensile strain capacity of the titanium powder cementitious composite.

Furthermore, the nitinol fibre reinforced cementitious composite (i.e., NT0.5 and NT1.0) showed significant strain-hardening effects indicated in Fig. 9a and b as the ''flat'' or ''plateau'' part of the diagram. At both 28 and 90 days of testing, the NTpowder showed brittle behaviour compared to NT1.0 and NT05.

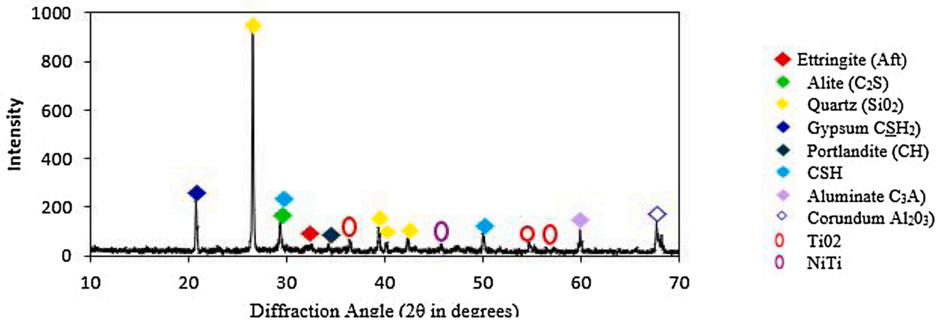
3.5. X-ray diffraction (XRD)test

Table 8 presents the summary of the main crystal phases identified in the XRD test at 28 days of curing. The highest crystal peak identified in both NT00 and NTpowder is quartz ($Si0_2$). There was 6 % more quartz (in counts) in NTpowder than in NT00. Furthermore, there was a high percentage of unreacted clinkers ($C_3S + C_2S + C_3A$), nearly twice as much in NT00 than in NTpowder. There were twice as many clinkers that were consumed in the hydration of NTpowder compared to NT00. This indicates that nitinol powder may possess pozzolanic properties and acts to accelerate the hydration of the cementitious composite [63,64]. The pozzolanic activity of nitinol powder led to 12.5 times reactivity of portlandite (CH) in NTpowder compared to NT00 (see Table 8; Fig. 10a and b). Thus after 28 days, only 2 % of portlandite in NTpowder were left unreacted compared to 19 % of unreacted portlandite in NT00. The consumption of more portlandite resulted in the formation of 10 % of C-S-H gel in NTpowder compared to 7 % in NT00. Thus, there was a reduction in the rate of formation of C-S-H gel in NTpowder over NT00 (i.e., only 1.14 times) compared to consumption of CH in NTpowder over NT00 (i.e., 12.5times).

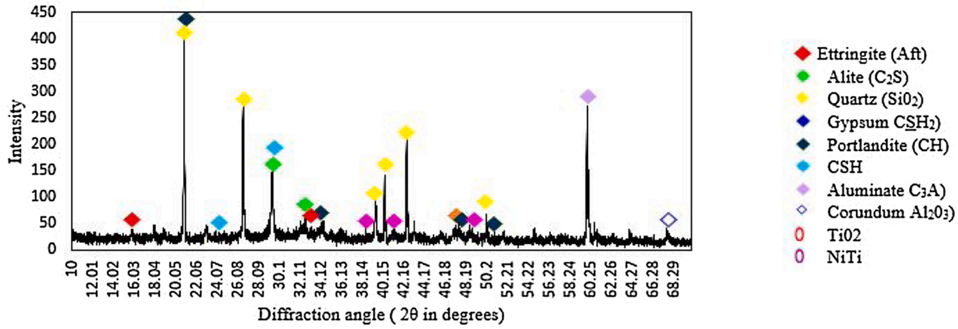
Comparing Fig. 10a–b, inclusion of nitinol powder in the cementitious composite had no significant effect on the extent of ettringite formation and resulted in no noticeable peaks for ferrite (C_4AF) and anhydrite (CS) in NTpowder. Furthermore, compared to NT00,

Table 8
Relative Intensities of crystal phases in nitinol powder reinforced cementitious composite.

Crystal	**NT00**		**NTpowder**	
	Intensity (Counts)	Relative Intensity (%)	Intensity (Counts)	Relative Intensity (%)
$C_3S + C_2S + C_3A$	589	20%	249	11%
CH	551	19 %	44	2 %
CSH	199	7 %	226	10 %
Aft	72	2 %	47	2 %
$Si0_2$	1090	37 %	1154	50 %
$C\underline{S}H_2$	129	4%	226	10 %
C_4AF	265	9%	0	0%
CS	43	1%	0	0%
Al_20_3	39	1%	136	6 %
NiTi	0	0%	60	3%
$Ti0_2$	0	0%	146	6 %



a – XRD spectra of nitinol powder reinforced cementitious composite



b – XRD spectra of cementitious composite

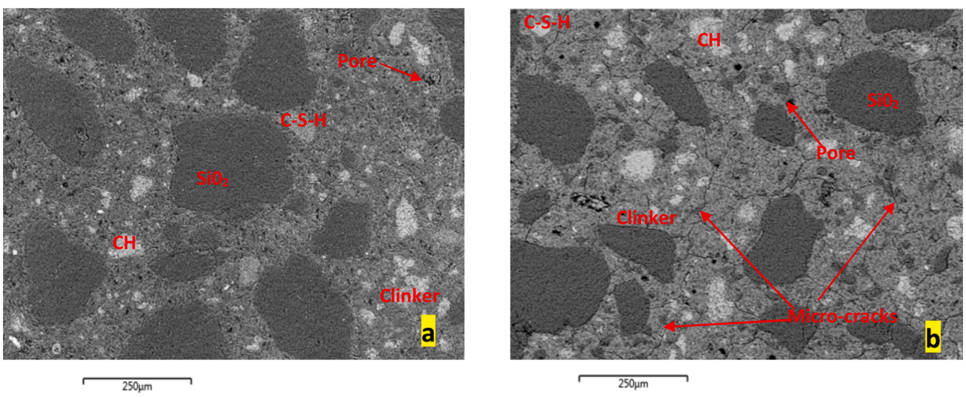
Fig. 10. a – XRD spectra of nitinol powder reinforced cementitious composite. Fig. 10b – XRD spectra of cementitious composite.

NTpowder showed TiO_2 and NiTi crystal phases in the cementitious composite. However, no noticeable crystal phase of Ni0 was observed.

3.6. SEM test

The main purpose of the SEM is to provide the microstructural images, and to determine the chemical composition, surface morphology, and crystal phases of the cementitious composite. The crystal phases observed for NT00 in the XRD test are similar to those obtained for NT0.5 and NT1.0. A large number of quartz (SiO_2) deposits as well as unreacted clinkers were obtained in both NT0.5 and NT1.0 (see Fig. 11a and b; Fig. 12). The SEM images also showed unreacted portlandite (CH) and C-S-H gel.

Even though all the samples had tiny pores on their surfaces, it can be observed that (see Fig. 11a and b; Fig. 12) NT1.0 had substantial micro-cracks compared to NT0.5). The larger micro-cracks in NT1.0 is due to the poor fibre-matrix bond of higher diameter



(a) NT0.5 (b) NT1.0

Fig. 11. – SEM image of (a) NT0.5 (b) NT1.0.

fibre (i.e., 1 mm) compared to a relatively lower diameter fibre (i.e., 0.5 mm). Naaman et al., [65] demonstrated that the diameter of fibres plays a crucial role in widening or closing cracks in cementitious composite. Larger diameter fibres have lower specific surface area compared to smaller diameter fibres [66] and forms a weak bond with the matrix.

As water is absorbed through the hydration process, tensile stresses are induced into the matrix and the weak bond between the fibres and the cementitious matrix led to cracking of the composite.

Additionally, the SEM image showed different elements, orientation, and morphology in the case of NTpowder. For instance, Fig. 13(a, c, e, f) show that, in addition to portlandite, C-S-H gel, unoxidized Nickel-Titanium as well as Titanium (IV) oxide ($Ti0_2$) and Nickel (II) Oxide (NiO were present. The Nickel-Titanium was surrounded by oxygen molecules causing the oxidation of the Nickel into NiO and Titanium into TiO_2. Moreover, by superimposing Fig. 13b–f on Fig. 13a, it can be seen that, both TiO_2 and NiO are surrounded by Calcium ions and all engulfed in SiO_2 (see Fig. 14).

The area surrounding the Nickel-Titanium was magnified (100 times) and the results are as shown in Fig. 15. Nucleation of the TiO_2, NiO and NiTi appeared on the surface of the C-S-H gel. Similar observations were reported by Han et al. [67] showing that, by coating $Si0_2$ with $Ti0_2$ there is nucleation of $Ti0_2$ onto the surface of C-S-H.

4. Effects of nitinol (NiTi), titanium (IV) oxide (TiO_2) and nickel (II) oxide (NiO) on the hydration and nucleation of cementitious composite

During the hydration process, Nitinol powder oxidizes in the presence of water to produce Titanium (IV) oxide (TiO_2) and Nickel (II) Oxide (NO). The TiO_2 and NiO are able to form Ti-O-Si and Ni-O-Si bond respectively [67,68]. This makes TiO_2 and the NiO more negatively charged [67] and repel each other in the cementitious solution, preventing agglomeration and enhancing dispersion in the mixture (see Fig. 16).

In the presence of a pool of SiO_2 in the cementitious solution (see Fig. 14) the charged TiO_2 and NiO forms respective bonds with SiO_2 (see Fig. 17). Whereas Titanium has two double bonds with oxygen onto the SiO_2 surface, NiO has only one double bond with oxygen onto the SiO_2 surface (see Fig. 17a and b), and therefore the bond between TiO_2 and SiO_2 is stronger and more stable than that between NiO and SiO_2. Thus, the bond energy between TiO_2 and SiO_2 is higher than that between NiO and SiO_2 as well [69].

Moreover, Ni^{2+} does not hydrolyse readily in the presence of water [70]. Nickel ion reacts with water under heat (i.e., heat of hydration) to produce NiO and subsequently bonds with SiO_2. During the hydration process, the negatively charged Ti-O-Si and Ni-O-Si react with portlandite (CH) to form TiO_2-C-S-H and NiO-C-S-H (see Fig. 18a and b).

According to Xie and Fang [71], nitinol powder is inert and acts to accelerate the hydration of cementitious composite due to seeding effect. When seeded with cementitious composite, nitinol promotes the growth of C-S-H. The C-S-H formed adheres to the surface of TiO_2 as well as the NiO (see Fig. 18a and b) and thus promotes nucleation reaction. This reaction can be described as pozzolanic reaction as it consumes 12.5 times the amount of CH compared to the mixture without nitinol powder (see Table 8). Wherefore, the hydration reaction gained more hydration product, promoting denser and compact mixture. Because many of the hydration product were formed as a result of the nucleation reaction between C-S-H and TiO_2 as well as the NiO, fewer pure C-S-H gel was formed. This explains why in both the XRD (see Fig. 10a) and SEM analysis (see Fig. 13) only 10 % pure C-S-H peaks were observed even though only 2 % of CH was left unreacted.

5. Relationship between microstructure and the mechanical properties of nitinol powder reinforced cementitious composite

The pozzolanic reaction influences the microstructure of the nitinol reinforced cementitious composite, which in turn affects its mechanical properties [64,72]. The basic mechanical property affected is the compressive strength [73]. Though the effect of NiO on the mechanical properties of cementitious composite has been shown to be limited, relevant studies reveal that TiO_2 has a significant effect on the mechanical properties of the composite. Thus, the maximum compressive strength achieved by the nitinol powder reinforced cementitious composite compared to both fibre and non-fibre reinforced nitinol cementitious composite can be attributed to the accelerated hydration of the cementitious composite [74], which promotes more compact and denser cementitious composite. Similar trend of increase in compressive strength as a result of the pozzolanic effect of TiO_2 have been achieved by numerous studies [62,75–77]. However, relevant studies on effects of TiO_2 in cementitious composites such as Ma et al. [62], Jayapalan [78], Wang et al. [79], Meng et al. [80] and Janus et al. [81] achieved a compressive strength below 100 MPa. On the other hand, this research which

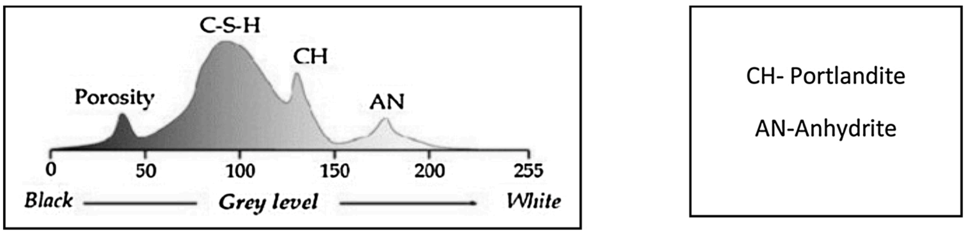


Fig. 12. – Legend of SEM images of hydrated cementitious composite.

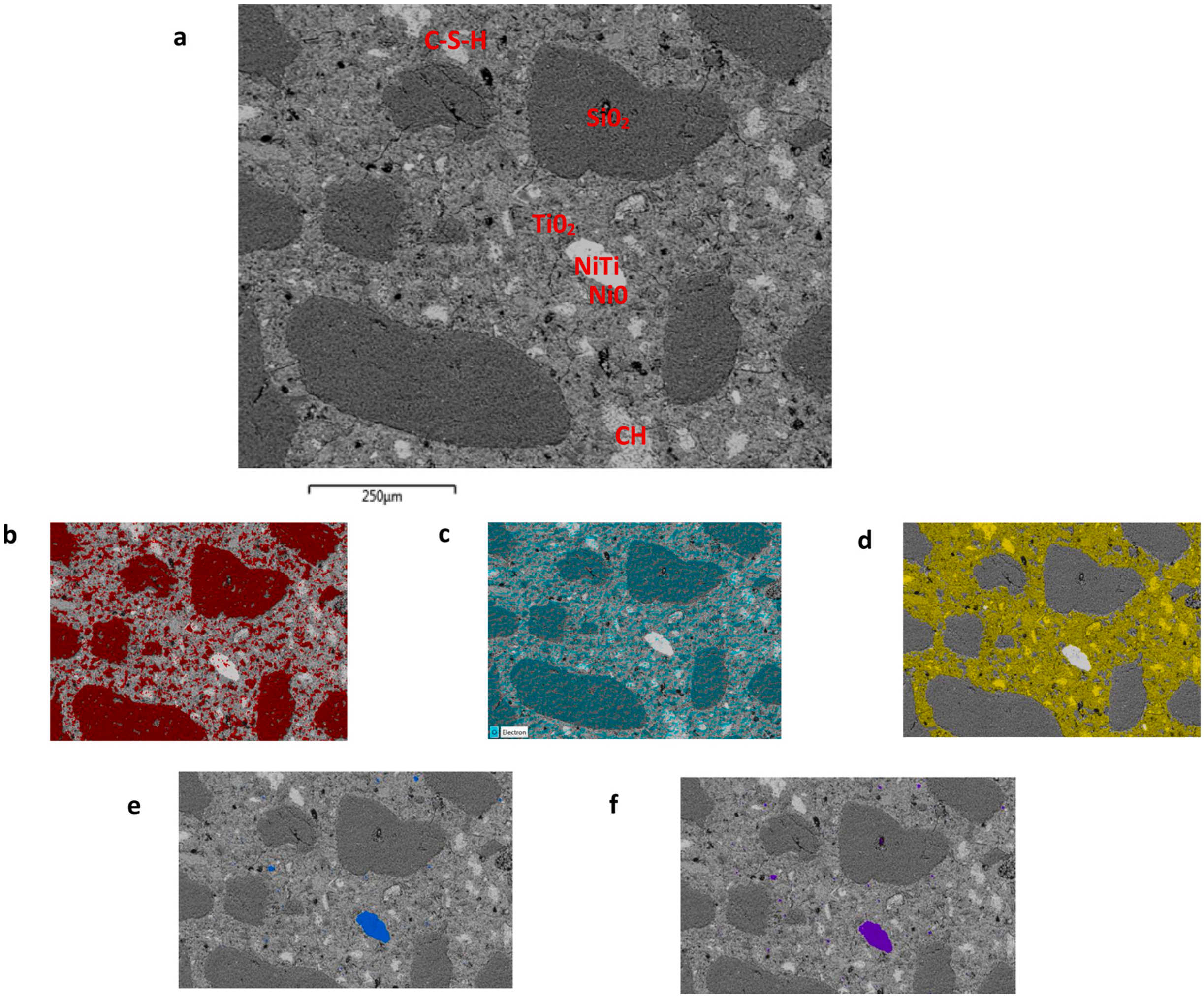


Fig. 13. -SEM of (a) NTpowder (b) Silicon (c) Oxygen (d) Calcium (e) Nickel (f) Titanium NTpowder cementitious composite.

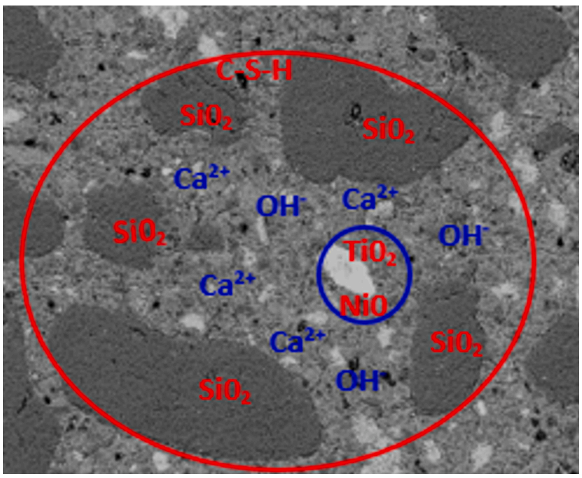


Fig. 14. -TiO_2 and NiO engulfed by calcium.

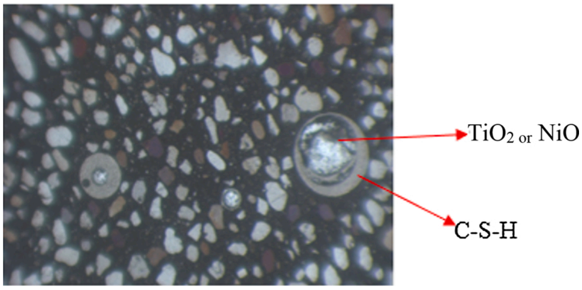


Fig. 15. -Nucleation of $Ti0_2/NiO_2$ onto C-S-H ions and SiO_2.

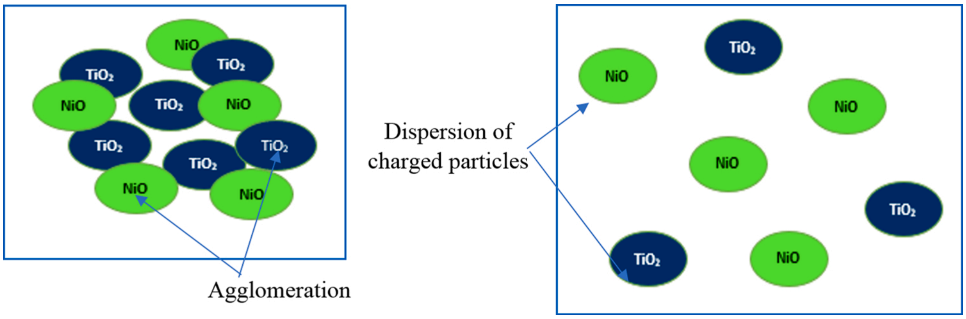


Fig. 16. – Dispersion of agglomerated charged TiO_2 and NiO in aqueous cementitious solution.

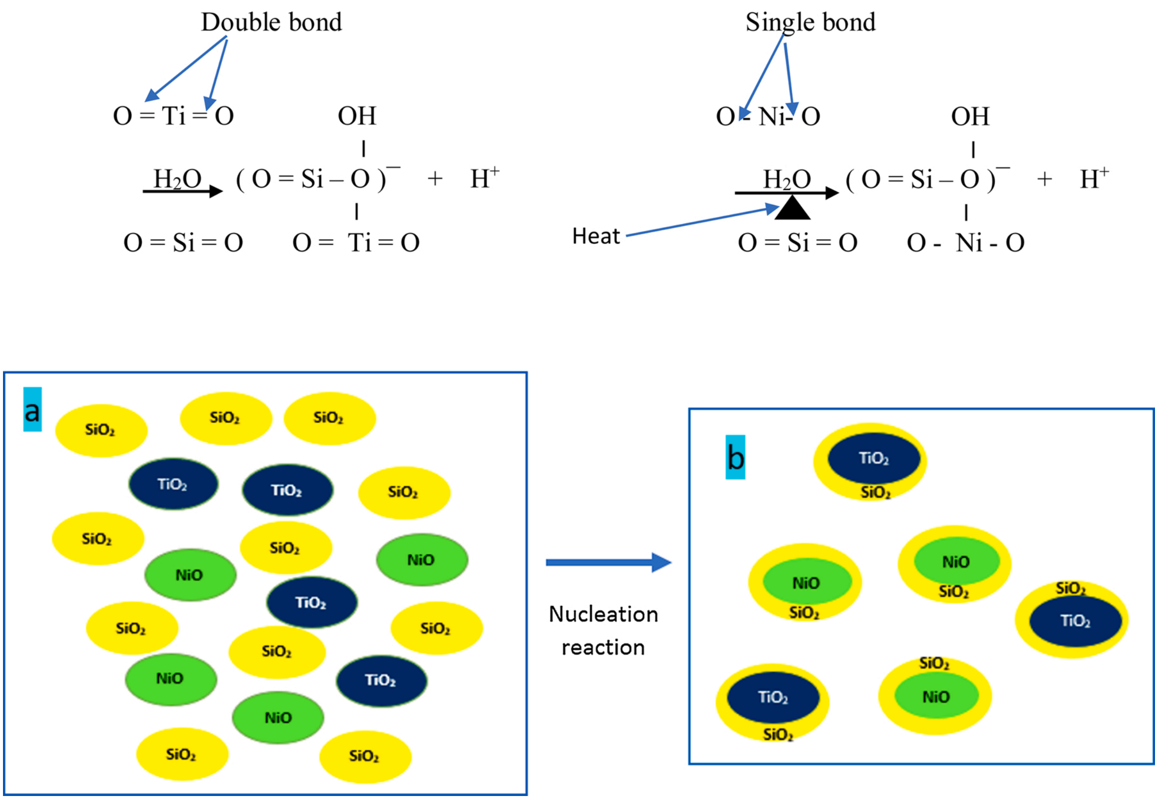


Fig. 17. – Reactivity between TiO_2 and NiO with SiO_2 in aqueous cementitious composite.

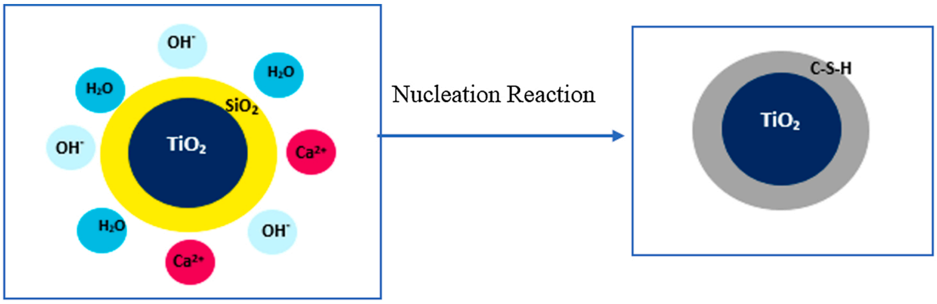


Fig 6.16a – Pozzolanic Effects of TiO_2 cementitious composite.

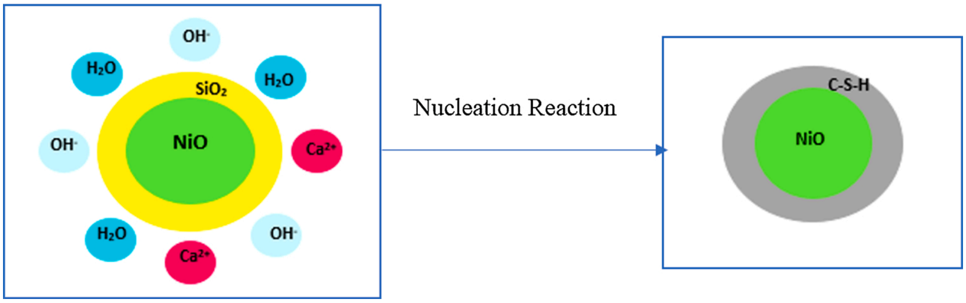


Fig. 18. a – Pozzolanic Effects of TiO_2 cementitious composite. Fig. 18b – Pozzolanic Effects of NiO cementitious composite.

incorporated NiTi powder in the cementitious composite achieved a compressive strength of 136 MPa. Thus, the combined effects of Ti^{2+} and Ni^{2+} ions contribute to better enhancement of the hydration process of the cementitious composite leading to higher compressive strength.

On the other hand, nitinol fibre reinforced cementitious composite developed pores and cracks (see Fig. 11a and b) on their surfaces because of their poor affinity with the cementitious composite. The increased porosity led to reduced compactness of the fibre reinforced cementitious composite and decreased compressive strength. Though porosity existed in both nitinol powder as well as nitinol fibre reinforced cementitious composites, the later achieved lower compressive strength. This trend is consistent with study by Wang et al. [82] which demonstrate that apart from porosity, the type of fibre reinforcement in the cementitious composite significantly affects its compressive strength.

The improved mechanical properties of Nitinol powder cementitious composite are also due to good bonding between the Ni^{2+} and Ti^{2+} ions and the hydration product. Ma et al. [62] implied that metallic ions such as Ni^{2+} and Ti^{2+} act as both adhesive and nodes which firmly bonds the C-S-H gel to the interfacial transition zone. Li et al. [83] further stated that this kind of bond sets up three-dimensional interwoven network framework which provides extra resistance to bending and deflection. However, under tension, the randomly distributed nitinol fibres produce more than three-dimensional network which distribute stresses across many directions which enhance the tensile stress resistance ability of the cementitious composite. Thus, nitinol fibre reinforced cementitious composite achieved higher resistance under tensile stress compared to nitinol powder reinforced cementitious composite (see Fig. 9a and b). Moreover, fibre aspect ratio played a significant role in achieving tensile resistance in the cementitious composite. With the same fibre length and volume, the finer fibres (i.e., the 0.5 mm instead of the 1 mm diameter) had much higher specific area compared to the 1 mm diameter fibre to form bonds within the matrix and therefore, improved tensile resistance.

6. Relationship between microstructure and the ductility of nitinol reinforced cementitious composite

Since fibres are primarily responsible for resisting tensile stresses in the cementitious composite, the mechanical behaviour of the fibres plays an important role in determining the ductility of the fibre reinforced composite [5,6]. The chemical bond that exists between the atoms of nickel-titanium alloy is a metallic bond. Though the ductility of nitinol fibre is 38 % [35]; (see Table 2), only 7 % ductility was achieved by the nitinol fibre reinforced cementitious composite alone.

The general increase in tensile strength from 28 day to 90days of curing observed in Fig. 9a and b is due to continuous hydration of the cementitious composite [58]. The change in the tensile performance during ageing comes from the intricate balance among the properties of the fibre-matrix interface [14]. The NT1.0 with the larger fibre diameter achieved reduced tensile strength because larger diameter fibres promote cracks in the composite compared to the lower diameter fibres [30]. This explains why the tensile strength of NT1.0 was reduced from 5.8 MPa to 4.1 MPa after 90 days of hydration.

The high ductility of nitinol fibres is linked to its intermolecular metallic bonding, but nitinol fibres form covalent bonds with the main hydration product C-S-H. This reduces the potency of nitinol fibres to confer its high ductility characteristics to the cementitious composite. By forming a weaker covalent bond, the nitinol fibres lost 82 % of their ductility potency, promoting only 7 % out of the 38 % of their ductility (compare Table 2 and Table 7). However, compared to other fibres, the ductility of nitinol fibres in cementitious composite outperforms both steel and PVA fibres (see Fig. 19).

The ductility of nitinol fibre reinforced cementitious composite was accompanied by strain hardening both at 28 and 90 days of curing (see Fig. 9a and b). The long stretch of strain hardening seen in Fig. 9a and b may be attributed to the nature of the nitinol fibre. The nitinol fibre used in this study was superelastic and has the ability of undergoing large plastic deformation under stress [22,23]. The strain hardening behaviour can also be attributed to the slipping of the metals under loading. This is because, even though nitinol powder reinforced cementitious composite did not use conventional use of micro fibres, it showed pseudo strain-hardening and achieved a maximum ductility of 3.1 % (Table7). The mechanism involved in achieving the relatively high ductility without the use of fibres can be attributed to the kind of bond nitinol powder forms with the C-S-H gel. During hydration of the cementitious composite, the heat causes the oxidation of Titanium and Nickel to form Titanium (IV) oxide (TiO_2) and Nickel (II) Oxide (NiO) respectively [67,68]. Both TiO_2 and NiO forms covalent bond with C-S-H gel. Unlike metallic bonds, covalent bonds are relatively brittle leading to relatively lower ductility of nitinol powder reinforced cementitious composite at 28 days of curing (see Fig. 7a). Even so, the ductility of nitinol powder in cementitious composite is slightly higher than that of steel fibres [4].

However, due to the low water-to-binder ratio, the nitinol powder cementitious composite was not fully hydrated at 28 days of wet curing [64,73,84]. Beyond the 28 days, the hydration processes continue at a relatively slower rate [63] and at reduced heat. This leads to the formation of more C-S-H gel and the consumption of the residual hydroxide (OH^-) ions as well as oxygen. As the demand for hydroxide and oxide ions increases for the hydration process, the TiO_2 and NiO underwent reduction reaction to metallic Titanium and Nickel respectively [85–87]. Nitinol powder acts to accelerate the hydration of cementitious composite and promote the formation or more C-S-H [71].

The Nickel and Titanium powdered metals form a ductile metallic bond between them and each forms a relatively brittle covalent bond with the hydration product C-S-H gel. This explains why at 90 days of wet curing, the ductility of nitinol powder cementitious composite increased from 2.8 % to 5.6 % (Fig. 9b). The larger specific surface area of the nitinol powder enhanced the bonding to the C-S-H gel, achieving relatively higher ductility at 90 days of curing compared to the composite reinforced with nitinol fibres (see Table 7).

7. Conclusion

This study considered the combined effects of nitinol powder and fibres on the ductility and the microstructure of cementitious composite. A series of chemo-mechanical tests were conducted to determine the relationship between the microstructure, ductility, and other mechanical properties. From the experimental results and discussions, the following has been observed:

1 The use of nitinol fibres as micro reinforcement generally decrease the compressive strength of the composite at 28 days of wet curing. A relatively higher diameter fibre promotes larger pores in the cemenitious composite leading to reduced compressive strength
2 Nitinol powder on the other hand, accelerates the hydration process and promotes nucleation of TiO_2 onto C-S-H leading to improved compressive and flexural behaviour.

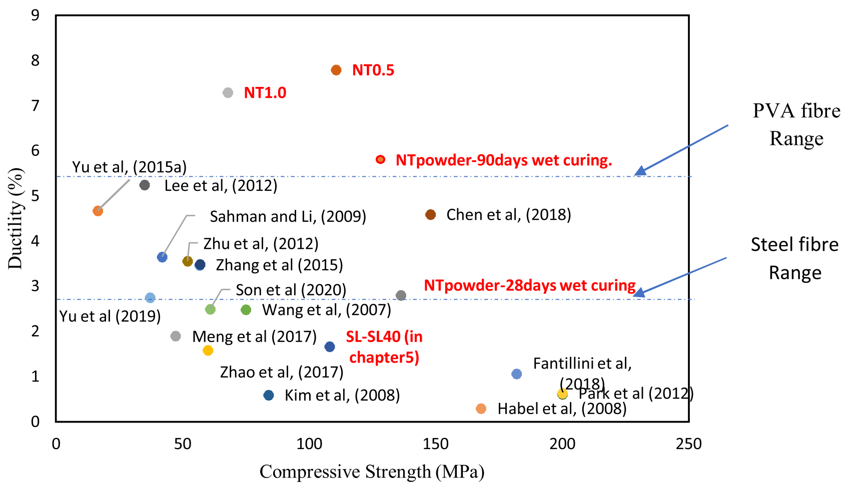


Fig. 19. Comparison of ductility performance of nitinol reinforced cementitious composite with steel and PVA fibre reinforced cementitious composites.

3 Nitinol fibre reinforced cementitious composite can achieve ductility of up to 7 % at 28 days of curing, making its ductility higher than that of steel and PVA fibre-based composite. The lower the diameter of the micro fibres, the higher the ductility of the cementitious composite.
4 Within 28 days of curing, the nitinol powder oxidizes under the heat of hydration to form TiO_2 and NiO. Both TiO_2 and NiO form covalent bonds with the C-S-H producing a less ductile cementitious composite.
5 Beyond 28 days of wet curing, the continuous hydration of the cementitious composite reacts with more hydroxide and oxide ions, causing a reduction reaction of TiO_2 and NiO into metal Titanium and Nickel ions respectively. The Titanium and Nickel ions form ductile metalic bond between themselves and brittle ionic bond with the C-S-H gel. After 90 days of curing, the nitinol powder reinforced cementitious composite can achieve ductility of 5.6 % without the use of fibres.

Declaration of Competing Interest

The authors report no declarations of interest.

Appendix A

APPENDIX 2-RAW DATA FOR NITINOL FIBRE REINFORCED CEMENTITIOUS COMPOSITES TESTS (CHAPTER SIX)

Appendix 2a – Raw Data for Flowability Test for Nitinol Reinforced Cementitious Composite

	Perpendicular Diameter (mm)			**Perpendicular Diameter (mm)**			**Perpendicular Diameter (mm)**		
Mixture ID	d1	d2	Average	d1	d2	Average	d1	d2	Average
NT00	160	162	161	162	160	161	161	163	162
NT0.5	125	120	123	123	125	124	121	122	122
NT1.0	145	142	144	143	141	142	140	142	141
NTPowder	161	162	162	160	161	161	160	161	161

Appendix 2b – Raw Data for Compressive Test for Nitinol Reinforced Cementitious Composite (Maximum Compressive Load)

		28-day Compressive Load (kN)			90-day Compressive Load(kN)		
	Mixture ID	Load 1	Load 2	Av.	Load 1	Load 2	Av.
	NT001	163.3	193.4	178.3	213.9	215.9	214.9
NT00	NT002	193.0	195.0	194.0	202.0	205.7	203.9
	NT003	181.0	185.3	183.2	216.9	221.8	219.4
	NT0.5 1	188.1	169.1	178.6	215.9	206.8	211.4
NT0.5	NT0.5 2	175.0	171.0	173.0	205.0	211.0	208.0
	NT0.5 3	194.8	164.8	179.8	233.4	224.5	229.0
	NT0.1 1	100.1	115.8	108.0	105.3	115.8	110.6
NT1.0	NT0.1 2	96.4	134.9	115.7	111.2	134.9	123.1
	NT0.1 3	104.0	100.8	102.4	115.0	119.0	117.0
	NTP1	220.9	227.3	224.1	260.1	228.6	244.3
NTP	NTP2	221.0	208.5	214.7	245.5	200.7	223.1
	NTP3	208.9	220.5	214.7	220.5	235	227.8

Appendix 2c – Raw Data for Compressive Strengths for Nitinol Reinforced Cementitious Composite (Maximum Compressive Strength)

	28- day Compressive Strength (MPa)					90 -day Compressive Strength (MPa)				
Mixture ID	Test 1	Test 2	Test 3	Average	STD*	Test 1	Test 2	Test 3	Average	STD*
NT00	178.3	194.0	183.2	185.2	8.0	214.9	203.9	219.4	212.7	8.0
NT0.5	178.6	173.0	179.8	177.1	3.6	211.4	208.0	229.0	216.1	11.3
NT1.0	108.0	115.7	102.4	108.7	6.7	110.6	117.6	117.0	115.1	3.9
NTP	224.1	214.7	214.7	217.8	5.4	244.3	223.1	227.8	231.7	11.2

Appendix 2d- 28day 3-Point Bending Test Data for NT00-Composite Composite (Average)

Extension (mm)	Deflection (mm)	Load (kN)	Strain %	Stress (MPa)										
0	0	0.01	0	0.04	0.14	9.33	2.36	0.09	8.85	0.23	15.56	4.13	0.15	15.50
0.00	0.22	0.16	0.00	0.61	0.14	9.56	2.41	0.09	9.04	0.27	18.00	4.86	0.17	18.23
0.00	0.22	0.11	0.00	0.41	0.14	9.56	2.46	0.09	9.23	0.28	18.33	4.91	0.17	18.41
0.01	0.44	0.16	0.00	0.60	0.15	9.78	2.51	0.09	9.41	0.28	18.33	4.96	0.17	18.60
0.02	1.11	0.21	0.01	0.78	0.15	10.00	2.56	0.09	9.60	0.28	18.67	5.01	0.18	18.79
0.02	1.33	0.26	0.01	0.97	0.15	10.00	2.61	0.09	9.79	0.28	18.67	5.06	0.18	18.98
0.03	1.78	0.31	0.02	1.17	0.15	10.22	2.66	0.10	9.97	0.28	18.67	5.11	0.18	19.16
0.03	2.22	0.36	0.02	1.36	0.15	10.22	2.71	0.10	10.16	0.28	18.67	5.16	0.18	19.35
0.03	2.22	0.41	0.02	1.53	0.16	10.44	2.76	0.10	10.35	0.29	19.00	5.21	0.18	19.54
0.04	2.89	0.46	0.03	1.73	0.16	10.67	2.81	0.10	10.54	0.29	19.00	5.26	0.18	19.73
0.04	2.89	0.51	0.03	1.92	0.16	10.67	2.86	0.10	10.73	0.29	19.33	5.31	0.18	19.91
0.05	3.11	0.56	0.03	2.10	0.16	10.89	2.91	0.10	10.91	0.29	19.33	5.36	0.18	20.10
0.05	3.56	0.61	0.03	2.29	0.16	10.89	2.96	0.10	11.10	0.29	19.33	5.41	0.18	20.29
0.05	3.56	0.66	0.03	2.47	0.17	11.11	3.01	0.10	11.29	0.29	19.33	5.46	0.18	20.48
0.06	3.78	0.71	0.04	2.66	0.17	11.33	3.06	0.11	11.48	0.29	19.33	5.51	0.18	20.66
0.06	4.22	0.76	0.04	2.85	0.17	11.33	3.11	0.11	11.66	0.30	19.67	5.56	0.18	20.85
0.07	4.44	0.81	0.04	3.04	0.17	11.56	3.16	0.11	11.85	0.30	20.00	5.61	0.19	21.04
0.07	4.44	0.86	0.04	3.22	0.17	11.56	3.21	0.11	12.04	0.30	20.00	5.66	0.19	21.23
0.07	4.67	0.91	0.04	3.42	0.18	11.78	3.26	0.11	12.22	0.30	20.00	5.71	0.19	21.41
0.08	5.11	0.96	0.05	3.60	0.18	12.00	3.31	0.11	12.42	0.30	20.00	5.76	0.19	21.60
0.08	5.11	1.01	0.05	3.79	0.18	12.00	3.36	0.11	12.60	0.30	20.00	5.81	0.19	21.79
0.08	5.33	1.06	0.05	3.98	0.18	12.00	3.41	0.11	12.79	0.31	20.33	5.86	0.19	21.98
0.08	5.56	1.11	0.05	4.17	0.18	12.22	3.46	0.11	12.98	0.31	20.33	5.91	0.19	22.16
0.09	5.78	1.16	0.05	4.36	0.18	12.22	3.51	0.11	13.17	0.31	20.67	5.96	0.19	22.35
0.09	5.78	1.21	0.05	4.54	0.19	12.67	3.56	0.12	13.35	0.32	21.33	4.77	0.20	17.90
0.09	6.00	1.26	0.06	4.73	0.19	12.67	3.61	0.12	13.54	0.32	21.33	6.06	0.20	22.73
0.10	6.44	1.31	0.06	4.91	0.19	12.67	3.66	0.12	13.73	0.32	21.33	6.11	0.20	22.91
0.10	6.44	1.36	0.06	5.10	0.19	12.67	3.71	0.12	13.91	0.32	21.33	6.16	0.20	23.10
0.10	6.44	1.41	0.06	5.29	0.19	12.89	3.76	0.12	14.10	0.33	22.00	6.21	0.21	23.28
0.10	6.67	1.46	0.06	5.48	0.20	13.33	3.81	0.13	14.29	0.33	22.00	6.26	0.21	23.48
0.10	6.89	1.51	0.06	5.67	0.20	13.33	3.86	0.13	14.48	0.33	22.00	6.31	0.21	23.67
0.11	7.11	1.56	0.07	5.85	0.20	13.33	3.91	0.13	14.66	0.33	22.00	6.36	0.21	23.85
0.11	7.11	1.61	0.07	6.04	0.20	13.33	3.96	0.13	14.85	0.33	22.00	6.41	0.21	24.04
0.11	7.11	1.66	0.07	6.22	0.20	13.56	4.01	0.13	15.04	0.33	22.00	6.46	0.21	24.23
0.11	7.56	1.71	0.07	6.42	0.20	13.56	4.06	0.13	15.23	0.34	22.67	6.51	0.21	24.41
0.12	7.78	1.76	0.07	6.60	0.21	14.00	4.11	0.13	15.42	0.34	22.67	6.56	0.21	24.60
0.12	7.78	1.81	0.07	6.79	0.21	14.00	4.16	0.13	15.60	0.34	22.67	6.61	0.21	24.79
0.12	7.78	1.86	0.07	6.98	0.21	14.00	4.21	0.13	15.79	0.36	24.00	3.90	0.23	14.64
0.12	8.22	1.91	0.08	7.17	0.21	14.00	4.26	0.13	15.98					
0.12	8.22	1.96	0.08	7.35	0.21	14.22	4.31	0.13	16.16					
0.13	8.44	2.01	0.08	7.54	0.21	14.22	4.36	0.13	16.35					
0.13	8.44	2.06	0.08	7.73	0.22	14.67	4.41	0.14	16.54					
0.13	8.67	2.11	0.08	7.91	0.22	14.67	4.46	0.14	16.73					
0.13	8.89	2.16	0.08	8.10	0.22	14.67	4.51	0.14	16.92					
0.13	8.89	2.21	0.08	8.29	0.22	14.67	4.56	0.14	17.10					
0.14	9.11	2.26	0.09	8.48	0.22	14.89	4.61	0.14	17.29					
					0.23	15.11	4.66	0.14	17.47					
					0.23	15.33	4.71	0.14	17.66					

Appendix 2e- 28day 3-Point Bending Test Data for NT0.5-Composite Composite (Average)

Extension (mm)	**Deflection** (mm)	**Load** (KN)	**Strain** %	**Stress** (MPa)																				
0.00	0.00	0.00	0.00	0.00	0.12	8.22	2.36	0.08	8.85	0.21	13.78	4.80	0.13	17.99	0.27	18.22	7.41	0.17	27.79					
0.00	0.00	0.03	0.00	0.11	0.12	8.22	2.40	0.08	9.01	0.21	13.78	4.84	0.13	18.15	0.27	18.22	7.45	0.17	27.93					
0.01	0.67	0.07	0.01	0.28	0.13	8.44	2.46	0.08	9.22	0.21	13.78	4.88	0.13	18.29	0.28	18.67	7.48	0.18	28.07					
0.02	1.33	0.13	0.01	0.49	0.13	8.44	2.50	0.08	9.37	0.21	13.78	4.92	0.13	18.44	0.28	18.67	7.54	0.18	28.28					
0.02	1.33	0.20	0.01	0.75	0.13	8.44	2.56	0.08	9.59	0.21	14.00	4.96	0.13	18.62	0.28	18.67	7.61	0.18	28.53					
0.02	1.56	0.25	0.01	0.93	0.13	8.89	2.61	0.08	9.79	0.21	14.00	5.01	0.13	18.79	0.28	18.67	7.67	0.18	28.77					
0.03	2.00	0.32	0.02	1.22	0.14	9.11	2.66	0.09	9.98	0.21	14.00	5.08	0.13	19.06	0.28	18.89	7.71	0.18	28.93					
0.03	2.22	0.36	0.02	1.35	0.14	9.11	2.71	0.09	10.18	0.22	14.44	5.11	0.14	19.17	0.28	18.89	7.76	0.18	29.09					
0.04	2.44	0.41	0.02	1.54	0.14	9.33	2.76	0.09	10.35	0.22	14.44	5.17	0.14	19.38	0.28	18.89	7.81	0.18	29.30					
0.04	2.89	0.44	0.03	1.66	0.14	9.33	2.81	0.09	10.54	0.22	14.44	5.21	0.14	19.54	0.28	18.89	7.87	0.18	29.53					
0.05	3.11	0.51	0.03	1.93	0.14	9.56	2.86	0.09	10.74	0.22	14.44	5.27	0.14	19.75	0.29	19.33	6.90	0.18	25.88					
0.05	3.11	0.58	0.03	2.16	0.15	10.00	2.91	0.09	10.92	0.22	14.44	5.31	0.14	19.91	0.30	19.67	7.91	0.18	29.67					
0.05	3.11	0.61	0.03	2.30	0.15	10.00	2.96	0.09	11.11	0.22	14.67	5.36	0.14	20.09	0.30	20.00	7.96	0.19	29.85					

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Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)															
0.06	3.78	0.66	0.04	2.48	0.15	10.00	3.00	0.09	11.25	0.22	14.67	5.40	0.14	20.24	0.30	20.00	8.01	0.19	30.04
0.06	4.00	0.72	0.04	2.68	0.15	10.00	3.06	0.09	11.49	0.22	14.67	5.44	0.14	20.39	0.30	20.00	8.06	0.19	30.23
0.06	4.00	0.77	0.04	2.87	0.15	10.00	3.11	0.09	11.67	0.23	15.11	5.48	0.14	20.56	0.30	20.00	8.09	0.19	30.34
0.06	4.00	0.82	0.04	3.08	0.15	10.22	3.16	0.10	11.86	0.23	15.11	5.53	0.14	20.73	0.30	20.00	8.16	0.19	30.60
0.07	4.44	0.86	0.04	3.24	0.15	10.22	3.20	0.10	12.01	0.23	15.11	5.57	0.14	20.89	0.31	20.33	8.19	0.19	30.71
0.07	4.44	0.91	0.04	3.40	0.16	10.67	3.26	0.10	12.23	0.23	15.11	5.61	0.14	21.03	0.31	20.33	8.22	0.19	30.83
0.07	4.67	0.96	0.04	3.60	0.16	10.67	3.31	0.10	12.42	0.23	15.33	5.65	0.14	21.18	0.31	20.33	8.25	0.19	30.94
0.07	4.67	1.01	0.04	3.78	0.16	10.89	3.36	0.10	12.60	0.23	15.33	5.69	0.14	21.33	0.31	20.67	8.28	0.19	31.04
0.07	4.67	1.07	0.04	4.00	0.17	11.11	3.40	0.10	12.76	0.23	15.33	5.74	0.14	21.54	0.31	20.67	8.31	0.19	31.14
0.08	5.11	1.10	0.05	4.13	0.17	11.11	3.47	0.10	13.03	0.23	15.33	5.79	0.14	21.70	0.32	21.00	5.25	0.20	19.68
0.08	5.33	1.15	0.05	4.31	0.17	11.11	3.51	0.10	13.17	0.24	15.78	5.83	0.15	21.86					
0.08	5.33	1.21	0.05	4.55	0.17	11.11	3.55	0.10	13.33	0.24	15.78	5.87	0.15	22.01					
0.08	5.33	1.26	0.05	4.72	0.17	11.11	3.59	0.10	13.46	0.24	15.78	6.06	0.15	22.73					
0.08	5.33	1.32	0.05	4.94	0.17	11.56	3.66	0.11	13.73	0.24	16.00	6.10	0.15	22.88					
0.09	6.00	1.36	0.06	5.09	0.17	11.56	3.72	0.11	13.95	0.24	16.00	6.16	0.15	23.10					
0.09	6.00	1.41	0.06	5.28	0.18	11.78	3.77	0.11	14.14	0.24	16.00	6.21	0.15	23.29					
0.09	6.00	1.46	0.06	5.49	0.18	11.78	3.80	0.11	14.24	0.24	16.00	6.26	0.15	23.48					
0.09	6.00	1.51	0.06	5.65	0.18	11.78	3.86	0.11	14.48	0.25	16.44	6.31	0.15	23.67					
0.09	6.00	1.56	0.06	5.87	0.18	11.78	3.91	0.11	14.67	0.25	16.44	6.36	0.15	23.85					
0.09	6.00	1.62	0.06	6.08	0.18	11.78	3.97	0.11	14.88	0.25	16.67	6.42	0.16	24.08					
0.10	6.67	1.66	0.06	6.24	0.18	12.22	4.01	0.11	15.04	0.25	16.67	6.46	0.16	24.23					
0.10	6.67	1.70	0.06	6.39	0.19	12.44	4.06	0.12	15.23	0.25	16.67	6.51	0.16	24.42					
0.10	6.67	1.75	0.06	6.58	0.19	12.44	4.11	0.12	15.42	0.25	16.67	6.56	0.16	24.60					
0.10	6.67	1.80	0.06	6.77	0.19	12.44	4.16	0.12	15.60	0.25	16.67	6.61	0.16	24.79					
0.10	6.89	1.87	0.06	7.01	0.19	12.44	4.21	0.12	15.79	0.25	16.67	6.66	0.16	24.98					
0.10	6.89	1.90	0.06	7.14	0.19	12.44	4.26	0.12	15.98	0.26	17.11	6.71	0.16	25.17					
0.11	7.33	1.96	0.07	7.36	0.19	12.44	4.31	0.12	16.17	0.26	17.11	6.76	0.16	25.35					
0.11	7.56	2.01	0.07	7.54	0.19	12.44	4.36	0.12	16.35	0.26	17.11	6.81	0.16	25.54					
0.11	7.56	1.73	0.07	6.50	0.20	13.11	4.41	0.12	16.54	0.26	17.33	6.85	0.16	25.70					
0.11	7.56	2.13	0.07	7.98	0.20	13.11	4.46	0.12	16.73	0.26	17.33	6.91	0.16	25.90					
0.11	7.56	2.17	0.07	8.15	0.20	13.11	4.51	0.12	16.92	0.26	17.33	6.95	0.16	26.07					
0.11	7.56	2.21	0.07	8.30	0.20	13.11	4.56	0.12	17.10	0.26	17.33	7.06	0.16	26.47					
0.12	8.22	2.27	0.08	8.52	0.20	13.11	4.61	0.12	17.28	0.26	17.56	7.12	0.16	26.69					
0.12	8.22	2.31	0.08	8.65	0.20	13.11	4.65	0.12	17.44	0.27	18.00	7.19	0.17	26.95					
					0.20	13.33	4.70	0.13	17.61	0.27	18.00	7.23	0.17	27.10					
					0.21	13.78	4.75	0.13	17.80	0.27	18.00	7.26	0.17	27.24					
										0.27	18.00	7.32	0.17	27.44					
										0.27	18.00	7.36	0.17	27.62					

Appendix 2f- 28day 3-Point Bending Test Data for NT1.0-Composite Composite (Average)

Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)															
0	0.00	0.01	0.00	0.04	0.17	11.33	2.36	0.11	8.85	0.26	17.56	4.81	0.16	18.04
0.00	0.00	0.20	0.00	0.75	0.17	11.56	2.41	0.11	9.04	0.26	17.56	4.86	0.16	18.23
0.00	0.00	0.11	0.00	0.42	0.17	11.56	2.46	0.11	9.23	0.27	18.22	4.25	0.17	15.94
0.00	0.00	0.16	0.00	0.60	0.18	11.78	2.51	0.11	9.41	0.29	19.00	4.96	0.18	18.60
0.01	0.44	0.21	0.00	0.79	0.18	12.00	2.56	0.11	9.60	0.29	19.33	5.01	0.18	18.79
0.01	0.67	0.26	0.01	0.98	0.18	12.00	2.61	0.11	9.79	0.29	19.33	5.06	0.18	18.98
0.02	1.11	0.31	0.01	1.17	0.18	12.22	2.66	0.11	9.97	0.29	19.33	5.11	0.18	19.16
0.03	1.78	0.36	0.02	1.36	0.19	12.44	2.71	0.12	10.16	0.29	19.33	5.16	0.18	19.35
0.03	1.78	0.41	0.02	1.54	0.19	12.44	2.76	0.12	10.35	0.30	19.67	5.21	0.18	19.54
0.04	2.44	0.46	0.02	1.73	0.19	12.67	2.81	0.12	10.54	0.30	19.67	5.26	0.18	19.73
0.04	2.44	0.51	0.02	1.92	0.19	12.67	2.86	0.12	10.73	0.30	20.00	5.31	0.19	19.91
0.04	2.67	0.56	0.03	2.10	0.19	12.89	2.91	0.12	10.91	0.30	20.00	5.36	0.19	20.10
0.05	3.11	0.61	0.03	2.29	0.20	13.11	2.96	0.12	11.10	0.30	20.00	5.41	0.19	20.29
0.05	3.11	0.66	0.03	2.47	0.20	13.11	3.01	0.12	11.29	0.30	20.00	5.46	0.19	20.48
0.05	3.56	0.71	0.03	2.66	0.20	13.33	3.06	0.13	11.48	0.30	20.00	5.51	0.19	20.66
0.06	3.78	0.76	0.04	2.85	0.20	13.33	3.11	0.13	11.66	0.31	20.33	5.56	0.19	20.85
0.06	4.22	0.81	0.04	3.04	0.21	13.78	3.16	0.13	11.85	0.31	20.67	5.61	0.19	21.04
0.06	4.22	0.86	0.04	3.23	0.21	13.78	3.21	0.13	12.04	0.31	20.67	5.66	0.19	21.23
0.07	4.67	0.91	0.04	3.42	0.21	13.78	3.26	0.13	12.23	0.31	20.67	5.71	0.19	21.41
0.07	4.89	0.96	0.05	3.61	0.21	14.00	3.31	0.13	12.42	0.31	20.67	5.76	0.19	21.60
0.07	4.89	1.01	0.05	3.79	0.21	14.00	3.36	0.13	12.60	0.31	20.67	5.81	0.19	21.79
0.08	5.33	1.06	0.05	3.98	0.21	14.22	3.41	0.13	12.79	0.32	21.00	5.86	0.20	21.98
0.08	5.33	1.11	0.05	4.17	0.22	14.44	3.46	0.14	12.98	0.32	21.00	5.91	0.20	22.16
0.09	5.78	1.16	0.05	4.36	0.22	14.44	3.51	0.14	13.16	0.32	21.33	5.96	0.20	22.35

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Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)															
0.09	5.78	1.21	0.05	4.54	0.22	14.67	3.56	0.14	13.35	0.33	22.00	4.77	0.21	17.90
0.09	6.22	1.26	0.06	4.73	0.22	14.67	3.61	0.14	13.54	0.34	22.67	6.06	0.21	22.73
0.10	6.44	1.31	0.06	4.91	0.22	14.89	3.66	0.14	13.73	0.34	22.67	6.11	0.21	22.91
0.10	6.67	1.36	0.06	5.10	0.22	14.89	3.71	0.14	13.91	0.34	22.67	6.16	0.21	23.10
0.10	6.67	1.41	0.06	5.29	0.23	15.11	3.76	0.14	14.10	0.34	22.67	6.21	0.21	23.28
0.10	6.89	1.46	0.06	5.48	0.23	15.33	3.81	0.14	14.29	0.35	23.33	6.26	0.22	23.48
0.10	6.44	1.51	0.06	5.67	0.23	15.33	3.86	0.14	14.48	0.35	23.33	6.31	0.22	23.67
0.10	6.44	1.56	0.06	5.85	0.23	15.56	3.91	0.15	14.66	0.35	23.33	6.36	0.22	23.85
0.10	6.44	1.61	0.06	6.04	0.23	15.56	3.96	0.15	14.85	0.35	23.33	6.41	0.22	24.04
0.10	6.67	1.66	0.06	6.23	0.24	15.78	4.01	0.15	15.04	0.35	23.33	6.46	0.22	24.23
0.11	7.11	1.71	0.07	6.41	0.24	15.78	4.06	0.15	15.23	0.36	24.00	6.51	0.23	24.41
0.11	7.11	1.76	0.07	6.60	0.24	16.22	4.11	0.15	15.42	0.36	24.00	6.56	0.23	24.60
0.11	7.33	1.81	0.07	6.78	0.24	16.22	4.16	0.15	15.60	0.36	24.00	6.61	0.23	24.79
0.11	7.33	1.86	0.07	6.98	0.24	16.22	4.21	0.15	15.79	0.36	24.00	3.90	0.23	14.64
0.12	7.78	1.91	0.07	7.16	0.24	16.22	4.26	0.15	15.98					
0.12	8.00	1.96	0.08	7.35	0.25	16.44	4.31	0.15	16.16					
0.12	8.00	2.01	0.08	7.54	0.25	16.67	4.36	0.16	16.35					
0.12	8.00	2.06	0.08	7.73	0.25	16.89	4.41	0.16	16.54					
0.12	8.22	2.11	0.08	7.91	0.25	16.89	4.46	0.16	16.73					
0.13	8.67	2.16	0.08	8.10	0.25	16.89	4.51	0.16	16.92					
0.13	8.67	2.21	0.08	8.29	0.25	16.89	4.56	0.16	17.10					
0.13	8.67	2.26	0.08	8.47	0.26	17.33	4.61	0.16	17.29					
0.17	11.33	2.31	0.11	8.66	0.26	17.33	4.66	0.16	17.47					
					0.26	17.56	4.71	0.16	17.66					
					0.26	17.56	4.76	0.16	17.85					

Appendix 2g- 28day 3-Point Bending Test Data for NTpowder-Composite Composite (Average)

Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)																				
0.00	0.00	0.01	0.00	0.04	0.13	8.44	2.36	0.08	8.86	0.21	13.78	4.81	0.13	18.04	0.29	19.33	7.26	0.18	27.23
0.00	0.00	0.10	0.00	0.37	0.13	8.44	2.41	0.08	9.05	0.21	13.78	4.86	0.13	18.23	0.29	19.33	7.31	0.18	27.42
0.00	0.22	0.11	0.00	0.41	0.13	8.44	2.46	0.08	9.23	0.21	13.78	4.91	0.13	18.42	0.29	19.56	7.36	0.18	27.61
0.00	0.22	0.16	0.00	0.59	0.13	8.89	2.51	0.08	9.42	0.21	14.22	4.96	0.13	18.61	0.29	19.56	7.41	0.18	27.79
0.01	0.89	0.21	0.01	0.79	0.14	9.11	2.56	0.09	9.61	0.21	14.22	5.01	0.13	18.79	0.30	19.78	7.46	0.19	27.98
0.02	1.11	0.26	0.01	0.98	0.14	9.11	2.61	0.09	9.79	0.21	14.22	5.06	0.13	18.98	0.30	19.78	7.51	0.19	28.17
0.02	1.56	0.31	0.01	1.17	0.14	9.11	2.66	0.09	9.98	0.22	14.44	5.11	0.14	19.17	0.30	19.78	7.56	0.19	28.36
0.03	1.78	0.36	0.02	1.36	0.14	9.11	2.71	0.09	10.17	0.22	14.44	5.16	0.14	19.36	0.30	19.78	7.61	0.19	28.54
0.03	2.00	0.41	0.02	1.54	0.14	9.33	2.76	0.09	10.36	0.22	14.44	5.21	0.14	19.55	0.30	20.00	7.66	0.19	28.73
0.04	2.44	0.46	0.02	1.73	0.14	9.56	2.81	0.09	10.54	0.22	14.67	5.26	0.14	19.73	0.30	20.00	7.71	0.19	28.92
0.04	2.67	0.51	0.03	1.92	0.15	9.78	2.86	0.09	10.73	0.22	14.89	5.31	0.14	19.92	0.30	20.22	7.76	0.19	29.11
0.04	2.67	0.56	0.03	2.11	0.15	9.78	2.91	0.09	10.92	0.22	14.89	5.36	0.14	20.11	0.31	20.44	7.81	0.19	29.30
0.05	3.11	0.61	0.03	2.29	0.15	9.78	2.96	0.09	11.11	0.22	14.89	5.41	0.14	20.29	0.31	20.44	7.86	0.19	29.48
0.05	3.33	0.66	0.03	2.48	0.15	10.00	3.01	0.09	11.29	0.23	15.11	5.46	0.14	20.48	0.31	20.44	7.91	0.19	29.67
0.05	3.33	0.71	0.03	2.67	0.15	10.00	3.06	0.09	11.48	0.23	15.11	5.51	0.14	20.67	0.31	20.44	7.96	0.19	29.86
0.06	4.00	0.76	0.04	2.86	0.15	10.22	3.11	0.10	11.67	0.23	15.33	5.56	0.14	20.86	0.31	20.44	8.01	0.19	30.05
0.06	4.00	0.81	0.04	3.05	0.15	10.22	3.16	0.10	11.86	0.23	15.33	5.61	0.14	21.04	0.31	20.44	8.06	0.19	30.23
0.06	4.00	0.86	0.04	3.23	0.16	10.44	3.21	0.10	12.04	0.23	15.33	5.66	0.14	21.23	0.31	20.89	8.11	0.20	30.42
0.07	4.44	0.91	0.04	3.42	0.16	10.67	3.26	0.10	12.23	0.23	15.56	5.71	0.15	21.42	0.32	21.11	8.16	0.20	30.60
0.07	4.67	0.96	0.04	3.61	0.16	10.67	3.31	0.10	12.42	0.23	15.56	5.76	0.15	21.61	0.32	21.11	8.21	0.20	30.80
0.07	4.67	1.01	0.04	3.80	0.16	10.67	3.36	0.10	12.61	0.23	15.56	5.81	0.15	21.80	0.32	21.11	8.26	0.20	30.98
0.07	4.89	1.06	0.05	3.98	0.16	10.89	3.41	0.10	12.79	0.24	16.00	5.86	0.15	21.98	0.32	21.11	8.31	0.20	31.17
0.08	5.11	1.11	0.05	4.17	0.16	10.89	3.46	0.10	12.98	0.24	16.00	5.91	0.15	22.17	0.32	21.11	8.36	0.20	31.36
0.08	5.33	1.16	0.05	4.36	0.17	11.11	3.51	0.10	13.17	0.24	16.00	5.96	0.15	22.36	0.32	21.11	8.41	0.20	31.54
0.08	5.33	1.21	0.05	4.54	0.17	11.33	3.56	0.11	13.36	0.24	16.00	6.01	0.15	22.54	0.32	21.33	8.46	0.20	31.73
0.08	5.56	1.26	0.05	4.73	0.17	11.33	3.61	0.11	13.54	0.24	16.00	6.06	0.15	22.73	0.32	21.56	8.51	0.20	31.92
0.09	5.78	1.31	0.05	4.92	0.17	11.33	3.66	0.11	13.73	0.24	16.22	6.11	0.15	22.92	0.33	21.78	8.56	0.20	32.11
0.09	5.78	1.36	0.05	5.11	0.17	11.56	3.71	0.11	13.92	0.24	16.22	6.16	0.15	23.11	0.33	21.33	8.61	0.20	32.29
0.09	6.00	1.41	0.06	5.30	0.17	11.56	3.76	0.11	14.11	0.25	16.67	6.21	0.16	23.30	0.33	22.00	8.66	0.21	32.48
0.09	6.22	1.46	0.06	5.48	0.17	11.56	3.81	0.11	14.29	0.25	16.67	6.26	0.16	23.48	0.33	22.00	8.71	0.21	32.66
0.09	6.22	1.51	0.06	5.67	0.18	12.00	3.86	0.11	14.48	0.25	16.67	6.31	0.16	23.67	0.33	22.00	8.76	0.21	32.85
0.10	6.44	1.56	0.06	5.85	0.18	12.00	3.91	0.11	14.67	0.25	16.67	6.36	0.16	23.86	0.34	22.67	8.81	0.21	33.04
0.10	6.44	1.61	0.06	6.04	0.18	12.00	3.96	0.11	14.86	0.25	16.67	6.41	0.16	24.05	0.34	22.67	8.86	0.21	33.23
0.10	6.67	1.66	0.06	6.24	0.18	12.00	4.01	0.11	15.04	0.25	16.89	6.46	0.16	24.23	0.34	22.67	8.91	0.21	33.41
0.10	6.89	1.71	0.06	6.42	0.18	12.22	4.06	0.11	15.23	0.26	17.11	6.51	0.16	24.42	0.35	23.33	8.96	0.22	33.60
0.11	7.11	1.76	0.07	6.61	0.19	12.44	4.11	0.12	15.42	0.26	17.11	6.56	0.16	24.60	0.35	23.33	9.01	0.22	33.79
0.11	7.11	1.81	0.07	6.79	0.19	12.44	4.16	0.12	15.61	0.26	17.33	6.61	0.16	24.80	0.35	23.33	9.06	0.22	33.98

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(*continued*)

Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)															
0.11	7.11	1.86	0.07	6.98	0.19	12.67	4.21	0.12	15.80	0.26	17.33	6.66	0.16	24.98	0.36	24.00	9.11	0.23	34.16
0.11	7.11	1.91	0.07	7.17	0.19	12.67	4.26	0.12	15.98	0.26	17.33	6.71	0.16	25.17	0.36	24.00	9.16	0.23	34.35
0.11	7.56	1.96	0.07	7.35	0.19	12.67	4.31	0.12	16.17	0.26	17.33	6.76	0.16	25.36	0.36	24.00	9.21	0.23	34.54
0.12	7.78	2.01	0.07	7.55	0.19	12.67	4.36	0.12	16.36	0.26	17.56	6.81	0.16	25.54	0.37	24.67	9.26	0.23	34.73
0.12	7.78	2.06	0.07	7.73	0.20	13.11	4.41	0.12	16.54	0.28	18.67	6.86	0.18	25.73	0.37	24.67	9.31	0.23	34.91
0.12	7.78	2.11	0.07	7.92	0.20	13.11	4.46	0.12	16.73	0.28	18.67	6.91	0.18	25.92	0.37	24.67	9.36	0.23	35.10
0.12	7.78	2.16	0.07	8.11	0.20	13.11	4.51	0.12	16.92	0.28	18.67	6.96	0.18	26.11	0.37	24.67	9.41	0.23	35.29
0.12	8.00	2.21	0.08	8.30	0.20	13.11	4.56	0.12	17.11	0.28	18.89	7.01	0.18	26.29	0.38	25.33	9.45	0.24	35.44
0.13	8.44	2.26	0.08	8.48	0.20	13.33	4.61	0.13	17.29	0.28	18.89	7.06	0.18	26.48	0.39	26.00	9.51	0.24	35.66
0.13	8.44	2.31	0.08	8.67	0.20	13.33	4.66	0.13	17.48	0.28	18.89	7.11	0.18	26.67	0.40	26.67	9.56	0.25	35.85
					0.20	13.56	4.71	0.13	17.67	0.29	19.11	7.16	0.18	26.86	0.41	27.33	5.53	0.26	20.75
					0.21	13.78	4.76	0.13	17.86	0.29	19.11	7.21	0.18	27.04					

Appendix 2h- 90day 3-Point Bending Test Data for NT00-Composite Composite (Average)

Extension (mm)	**Deflection (mm)**	**Load (kN)**	**Strain %**	**Stress (MPa)**										
0.00	0.00	0.01	0.00	0.04	0.16	16.00	2.31	0.15	8.67	0.25	21.78	4.81	0.20	18.04
0.00	5.11	0.07	0.05	0.27	0.16	16.00	2.36	0.15	8.85	0.25	21.78	4.86	0.20	18.23
0.01	5.56	0.11	0.05	0.42	0.16	16.00	2.41	0.15	9.04	0.25	22.00	4.91	0.21	18.41
0.02	6.22	0.16	0.06	0.59	0.17	16.22	2.46	0.15	9.23	0.25	22.00	4.96	0.21	18.60
0.03	6.89	0.21	0.06	0.79	0.17	16.67	2.51	0.16	9.41	0.26	22.22	5.01	0.21	18.79
0.04	7.56	0.26	0.07	0.98	0.17	16.67	2.56	0.16	9.60	0.26	22.44	5.06	0.21	18.97
0.04	7.78	0.31	0.07	1.16	0.17	16.67	2.61	0.16	9.79	0.26	22.44	5.11	0.21	19.17
0.04	8.00	0.36	0.08	1.34	0.17	16.67	2.66	0.16	9.97	0.26	22.44	5.16	0.21	19.35
0.05	8.44	0.41	0.08	1.54	0.18	16.89	2.71	0.16	10.17	0.26	22.44	5.21	0.21	19.54
0.05	8.67	0.46	0.08	1.72	0.18	17.33	2.76	0.16	10.36	0.26	22.67	5.26	0.21	19.73
0.06	9.11	0.51	0.09	1.91	0.18	17.33	2.81	0.16	10.54	0.26	22.67	5.31	0.21	19.91
0.06	9.33	0.56	0.09	2.10	0.18	17.33	2.86	0.16	10.73	0.27	23.11	5.36	0.22	20.10
0.07	9.56	0.61	0.09	2.29	0.18	17.33	2.91	0.16	10.92	0.27	23.11	5.41	0.22	20.29
0.07	10.00	0.66	0.09	2.48	0.19	17.56	2.96	0.16	11.10	0.28	23.56	4.68	0.22	17.57
0.08	10.22	0.71	0.10	2.67	0.19	17.78	3.01	0.17	11.29	0.27	23.33	5.51	0.22	20.66
0.08	10.22	0.76	0.10	2.85	0.19	18.00	3.06	0.17	11.48	0.28	24.00	4.43	0.23	16.61
0.08	10.44	0.81	0.10	3.04	0.19	18.00	3.11	0.17	11.66	0.28	24.00	5.61	0.23	21.05
0.09	10.89	0.86	0.10	3.23	0.19	18.00	3.16	0.17	11.85	0.28	24.00	5.66	0.23	21.23
0.09	10.89	0.91	0.10	3.41	0.20	18.22	3.21	0.17	12.04	0.29	24.67	5.71	0.23	21.42
0.09	11.33	0.96	0.11	3.61	0.20	18.22	3.26	0.17	12.23	0.29	24.67	5.76	0.23	21.61
0.09	11.33	1.01	0.11	3.79	0.20	18.44	3.31	0.17	12.41	0.29	24.67	5.81	0.23	21.80
0.10	11.78	1.06	0.11	3.98	0.20	18.67	3.36	0.18	12.60	0.30	25.33	3.42	0.24	12.81
0.10	11.78	1.11	0.11	4.16	0.20	18.67	3.41	0.18	12.79					
0.11	12.22	1.16	0.11	4.36	0.21	18.89	3.46	0.18	12.98					
0.11	12.22	1.21	0.11	4.54	0.21	18.89	3.51	0.18	13.16					
0.11	12.44	1.26	0.12	4.72	0.21	19.11	3.56	0.18	13.35					
0.11	12.67	1.31	0.12	4.92	0.21	19.11	3.61	0.18	13.54					
0.12	12.89	1.36	0.12	5.10	0.21	19.33	3.66	0.18	13.73					
0.12	13.11	1.41	0.12	5.29	0.21	19.33	3.71	0.18	13.91					
0.12	13.33	1.46	0.13	5.48	0.22	19.56	3.76	0.18	14.10					
0.12	13.33	1.51	0.13	5.67	0.22	19.56	3.81	0.18	14.29					
0.13	13.78	1.56	0.13	5.85	0.22	19.78	3.86	0.19	14.48					
0.13	13.78	1.61	0.13	6.04	0.22	19.78	3.91	0.19	14.66					
0.13	14.00	1.66	0.13	6.23	0.22	20.00	3.96	0.19	14.85					
0.14	14.22	1.71	0.13	6.42	0.23	20.22	4.01	0.19	15.04					
0.14	14.44	1.76	0.14	6.60	0.23	20.22	4.06	0.19	15.23					
0.14	14.44	1.81	0.14	6.79	0.23	20.22	4.11	0.19	15.41					
0.14	14.67	1.86	0.14	6.98	0.23	20.44	4.16	0.19	15.60					
0.15	14.89	1.91	0.14	7.17	0.23	20.44	4.21	0.19	15.79					
0.15	14.89	1.96	0.14	7.35	0.23	20.44	4.26	0.19	15.97					
0.15	15.11	2.01	0.14	7.54	0.24	20.89	4.31	0.20	16.17					
0.15	15.33	2.06	0.14	7.72	0.24	20.89	4.36	0.20	16.35					
0.15	15.33	2.11	0.14	7.92	0.24	20.89	4.41	0.20	16.54					
0.15	15.33	2.16	0.14	8.10	0.24	21.11	4.46	0.20	16.73					
0.16	15.56	2.21	0.15	8.29	0.24	21.11	4.51	0.20	16.91					
0.16	16.00	2.26	0.15	8.48	0.24	21.11	4.56	0.20	17.10					
0.16	16.00	2.31	0.15	8.67	0.24	21.33	4.61	0.20	17.29					
					0.25	21.56	4.66	0.20	17.48					
					0.25	21.56	4.71	0.20	17.66					
					0.25	21.78	4.76	0.20	17.85					

Appendix 2i- 90day 3-Point Bending Test Data for NT0.5-Composite Composite (Average)

Extension (mm)	Deflection (mm)	Load (kN)	Strain %	Stress (MPa)																				
0.00	0.00	0.01	0.00	0.04	0.20	13.11	2.36	0.12	8.85	0.29	19.11	4.81	0.18	18.04	0.37	24.44	7.26	0.23	27.22	0.53	35.00	9.71	0.33	36.41
0.00	0.00	0.10	0.00	0.38	0.20	13.33	2.41	0.13	9.04	0.29	19.11	4.86	0.18	18.22	0.37	24.44	7.31	0.23	27.41	0.53	35.00	9.76	0.33	36.60
0.03	2.22	0.11	0.02	0.40	0.20	13.56	2.46	0.13	9.22	0.29	19.56	4.91	0.18	18.41	0.37	24.44	7.36	0.23	27.60	0.53	35.33	9.81	0.33	36.79
0.04	2.67	0.16	0.03	0.59	0.21	13.78	2.51	0.13	9.41	0.30	19.78	4.96	0.19	18.60	0.37	24.44	7.41	0.23	27.79	0.53	35.33	9.86	0.33	36.98
0.05	3.11	0.21	0.03	0.78	0.21	13.78	2.56	0.13	9.60	0.30	19.78	5.01	0.19	18.79	0.37	24.44	7.46	0.23	27.97	0.54	36.00	7.80	0.34	29.27
0.05	3.56	0.26	0.03	0.97	0.21	13.78	2.61	0.13	9.78	0.30	19.78	5.06	0.19	18.97	0.37	24.67	7.51	0.23	28.16	0.55	36.67	9.96	0.34	37.35
0.06	4.22	0.31	0.04	1.17	0.21	14.00	2.66	0.13	9.98	0.30	19.78	5.11	0.19	19.16	0.37	24.67	7.56	0.23	28.35	0.55	36.67	10.01	0.34	37.54
0.07	4.67	0.36	0.04	1.35	0.22	14.44	2.71	0.14	10.16	0.30	19.78	5.16	0.19	19.35	0.38	25.11	7.61	0.24	28.54	0.56	37.33	10.06	0.35	37.73
0.08	5.33	0.41	0.05	1.54	0.22	14.44	2.76	0.14	10.35	0.30	20.00	5.21	0.19	19.54	0.38	25.11	7.66	0.24	28.72	0.56	37.33	10.11	0.35	37.92
0.08	5.56	0.46	0.05	1.73	0.22	14.44	2.81	0.14	10.54	0.31	20.44	5.26	0.19	19.72	0.38	25.11	7.71	0.24	28.91	0.56	37.33	10.16	0.35	38.10
0.09	5.78	0.51	0.05	1.91	0.22	14.44	2.86	0.14	10.73	0.31	20.44	5.31	0.19	19.91	0.38	25.11	7.76	0.24	29.10	0.57	38.00	5.88	0.36	22.04
0.09	6.22	0.56	0.06	2.10	0.22	14.67	2.91	0.14	10.91	0.31	20.44	5.36	0.19	20.10	0.38	25.11	7.81	0.24	29.29					
0.10	6.67	0.61	0.06	2.29	0.23	15.11	2.96	0.14	11.10	0.31	20.44	5.41	0.19	20.29	0.38	25.33	7.86	0.24	29.47					
0.10	6.67	0.66	0.06	2.47	0.23	15.11	3.01	0.14	11.29	0.31	20.44	5.46	0.19	20.47	0.38	25.33	7.91	0.24	29.66					
0.11	7.11	0.71	0.07	2.66	0.23	15.11	3.06	0.14	11.47	0.31	20.67	5.51	0.19	20.66	0.38	25.56	7.96	0.24	29.85					
0.11	7.33	0.76	0.07	2.85	0.23	15.11	3.11	0.14	11.66	0.31	20.89	5.56	0.20	20.85	0.39	25.78	8.01	0.24	30.04					
0.11	7.56	0.81	0.07	3.03	0.23	15.11	3.16	0.14	11.85	0.32	21.11	5.61	0.20	21.04	0.39	25.78	8.06	0.24	30.22					
0.12	8.22	0.86	0.08	3.23	0.24	15.78	3.21	0.15	12.04	0.32	21.11	5.66	0.20	21.22	0.39	25.78	8.11	0.24	30.41					
0.12	8.22	0.91	0.08	3.41	0.24	15.78	3.26	0.15	12.23	0.32	21.11	5.71	0.20	21.41	0.39	25.78	8.16	0.24	30.60					
0.12	8.22	0.96	0.08	3.59	0.24	15.78	3.31	0.15	12.41	0.32	21.11	5.76	0.20	21.60	0.39	26.00	8.21	0.24	30.79					
0.13	8.67	1.01	0.08	3.78	0.24	15.78	3.36	0.15	12.60	0.32	21.11	5.81	0.20	21.79	0.39	26.00	8.26	0.24	30.97					
0.13	8.89	1.06	0.08	3.98	0.24	15.78	3.41	0.15	12.79	0.32	21.33	5.86	0.20	21.98	0.39	26.22	8.31	0.25	31.16					
0.14	9.11	1.11	0.09	4.16	0.24	16.22	3.46	0.15	12.97	0.33	21.78	5.91	0.20	22.16	0.40	26.44	8.36	0.25	31.35					
0.14	9.33	1.16	0.09	4.35	0.25	16.44	3.51	0.15	13.16	0.33	21.78	5.96	0.20	22.35	0.40	26.44	8.41	0.25	31.54					
0.14	9.56	1.21	0.09	4.54	0.25	16.44	3.56	0.15	13.35	0.33	21.78	6.01	0.20	22.54	0.40	26.44	8.46	0.25	31.72					
0.15	9.78	1.26	0.09	4.73	0.25	16.44	3.61	0.15	13.54	0.33	21.78	6.06	0.20	22.73	0.40	26.44	8.51	0.25	31.91					
0.15	9.78	1.31	0.09	4.91	0.25	16.44	3.66	0.15	13.72	0.33	21.78	6.11	0.20	22.91	0.40	26.67	8.56	0.25	32.10					
0.15	10.22	1.36	0.10	5.10	0.25	16.44	3.71	0.15	13.91	0.33	22.00	6.16	0.21	23.10	0.40	26.67	8.61	0.25	32.29					
0.15	10.22	1.41	0.10	5.29	0.26	17.11	3.76	0.16	14.10	0.33	22.22	6.21	0.21	23.29	0.40	26.67	8.66	0.25	32.47					
0.16	10.44	1.46	0.10	5.48	0.26	17.11	3.81	0.16	14.29	0.34	22.44	6.26	0.21	23.47	0.41	27.11	8.71	0.25	32.66					
0.16	10.67	1.51	0.10	5.66	0.26	17.11	3.86	0.16	14.47	0.34	22.44	6.31	0.21	23.66	0.41	27.11	8.76	0.25	32.85					
0.16	10.89	1.56	0.10	5.85	0.26	17.11	3.91	0.16	14.66	0.34	22.44	6.36	0.21	23.85	0.41	27.11	8.81	0.25	33.04					
0.16	10.89	1.61	0.10	6.04	0.26	17.11	3.96	0.16	14.85	0.34	22.44	6.41	0.21	24.04	0.41	27.11	8.86	0.25	33.23					
0.17	11.11	1.66	0.10	6.22	0.26	17.33	4.01	0.16	15.04	0.34	22.44	6.46	0.21	24.22	0.41	27.33	8.91	0.26	33.41					
0.17	11.33	1.71	0.11	6.41	0.27	17.78	4.06	0.17	15.23	0.34	22.67	6.51	0.21	24.41	0.41	27.33	8.96	0.26	33.60					
0.17	11.56	1.76	0.11	6.60	0.27	17.78	4.11	0.17	15.41	0.34	22.89	6.56	0.21	24.60	0.41	27.33	9.01	0.26	33.79					
0.17	11.56	1.81	0.11	6.78	0.27	17.78	4.16	0.17	15.60	0.35	23.11	6.61	0.22	24.79	0.42	28.00	7.78	0.26	29.16					
0.18	11.78	1.86	0.11	6.97	0.27	17.78	4.21	0.17	15.79	0.35	23.11	6.66	0.22	24.97	0.51	34.00	9.11	0.32	34.16					
0.18	12.00	1.91	0.11	7.17	0.27	17.78	4.26	0.17	15.97	0.35	23.11	6.71	0.22	25.16	0.51	34.00	9.16	0.32	34.35					
0.18	12.22	1.96	0.11	7.35	0.27	18.22	4.31	0.17	16.16	0.35	23.11	6.76	0.22	25.35	0.51	34.00	9.21	0.32	34.54					
0.18	12.22	2.01	0.11	7.54	0.28	18.44	4.36	0.17	16.35	0.35	23.33	6.81	0.22	25.54	0.51	34.00	9.26	0.32	34.73					
0.19	12.44	2.06	0.12	7.73	0.28	18.44	4.41	0.17	16.54	0.35	23.33	6.86	0.22	25.72	0.52	34.33	9.31	0.32	34.91					
0.19	12.44	2.11	0.12	7.91	0.28	18.44	4.46	0.17	16.72	0.35	23.56	6.91	0.22	25.91	0.52	34.33	9.36	0.32	35.10					
0.19	12.67	2.16	0.12	8.10	0.28	18.44	4.51	0.17	16.91	0.36	23.78	6.96	0.22	26.10	0.52	34.67	9.41	0.33	35.29					
0.19	12.89	2.21	0.12	8.28	0.28	18.44	4.56	0.17	17.10	0.36	23.78	7.01	0.22	26.29	0.52	34.67	9.46	0.33	35.48					
0.20	13.11	2.26	0.12	8.48	0.28	18.89	4.61	0.18	17.29	0.36	23.78	7.06	0.22	26.47	0.52	34.67	9.51	0.33	35.66					
0.20	13.11	2.31	0.12	8.66	0.29	19.11	4.66	0.18	17.48	0.36	23.78	7.11	0.22	26.66	0.52	34.67	9.56	0.33	35.85					
					0.29	19.11	4.71	0.18	17.66	0.36	24.00	7.16	0.23	26.85	0.52	34.67	9.61	0.33	36.04					
					0.29	19.11	4.76	0.18	17.85	0.36	24.00	7.21	0.23	27.04	0.53	35.00	9.66	0.33	36.23					

Appendix 2j- 90day 3-Point Bending Test Data for NT1.0-Composite Composite (Average)

Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)																				
0.00	0.00	0.01	0.00	0.04	0.16	10.89	2.36	0.10	8.86	0.24	16.00	4.81	0.15	18.05	0.39	26.00	7.26	0.24	27.23	0.46	30.33	9.66	0.28	36.23
0.00	0.00	0.11	0.00	0.40	0.16	10.89	2.41	0.10	9.04	0.24	16.22	4.86	0.15	18.23	0.40	26.33	7.31	0.25	27.42	0.46	30.33	9.71	0.28	36.42
0.01	0.44	0.11	0.00	0.42	0.16	10.89	2.46	0.10	9.23	0.25	16.67	4.91	0.16	18.42	0.40	26.33	7.36	0.25	27.61	0.46	30.33	9.76	0.28	36.61
0.01	0.67	0.16	0.01	0.60	0.17	11.33	2.51	0.11	9.42	0.25	16.67	4.96	0.16	18.61	0.40	26.33	7.41	0.25	27.79	0.47	31.00	7.84	0.29	29.40
0.04	2.44	0.22	0.02	0.83	0.17	11.33	2.56	0.11	9.60	0.25	16.67	5.01	0.16	18.80	0.40	26.33	7.46	0.25	27.98	0.46	30.67	9.86	0.29	36.99
0.04	2.89	0.26	0.03	0.98	0.17	11.56	2.61	0.11	9.80	0.25	16.67	5.06	0.16	18.98	0.40	26.33	7.51	0.25	28.17	0.46	30.67	9.91	0.29	37.17
0.05	3.56	0.31	0.03	1.16	0.17	11.56	2.66	0.11	9.98	0.25	16.67	5.11	0.16	19.17	0.40	26.33	7.56	0.25	28.36	0.46	30.67	9.96	0.29	37.36
0.06	3.78	0.36	0.04	1.36	0.17	11.56	2.71	0.11	10.17	0.25	16.89	5.16	0.16	19.36	0.40	26.67	7.61	0.25	28.54	0.47	31.33	10.01	0.29	37.55
0.06	4.22	0.41	0.04	1.54	0.18	11.78	2.76	0.11	10.36	0.26	17.11	5.21	0.16	19.55	0.41	27.00	7.66	0.25	28.73	0.49	32.67	5.85	0.31	21.92
0.07	4.44	0.46	0.04	1.73	0.18	12.00	2.81	0.11	10.54	0.26	17.11	5.26	0.16	19.73	0.41	27.00	7.71	0.25	28.92					
0.07	4.67	0.51	0.04	1.92	0.18	12.00	2.86	0.11	10.73	0.26	17.33	5.31	0.16	19.92	0.41	27.00	7.76	0.25	29.11					
0.08	5.11	0.56	0.05	2.11	0.18	12.22	2.91	0.11	10.92	0.26	17.33	5.36	0.16	20.11	0.41	27.00	7.81	0.25	29.30					
0.08	5.11	0.61	0.05	2.30	0.18	12.22	2.96	0.11	11.11	0.26	17.33	5.41	0.16	20.30	0.41	27.00	7.86	0.25	29.48					
0.09	5.78	0.66	0.05	2.48	0.19	12.44	3.01	0.12	11.29	0.26	17.33	5.46	0.16	20.48	0.41	27.00	7.91	0.25	29.67					
0.09	5.78	0.71	0.05	2.67	0.19	12.67	3.06	0.12	11.48	0.26	17.56	5.51	0.16	20.67	0.41	27.00	7.96	0.25	29.85					
0.09	5.78	0.76	0.05	2.86	0.19	12.67	3.11	0.12	11.67	0.27	17.78	5.56	0.17	20.86	0.41	27.33	8.01	0.26	30.05					
0.09	6.22	0.81	0.06	3.05	0.19	12.67	3.16	0.12	11.86	0.27	17.78	5.61	0.17	21.05	0.42	27.67	8.06	0.26	30.23					
0.10	6.44	0.86	0.06	3.24	0.19	12.89	3.21	0.12	12.04	0.27	18.00	5.66	0.17	21.23	0.42	27.67	8.11	0.26	30.42					
0.10	6.44	0.91	0.06	3.42	0.19	12.89	3.26	0.12	12.23	0.27	18.00	5.71	0.17	21.42	0.42	27.67	8.16	0.26	30.60					
0.10	6.67	0.96	0.06	3.61	0.20	13.11	3.31	0.12	12.42	0.27	18.00	5.76	0.17	21.61	0.42	27.67	8.21	0.26	30.79					
0.11	7.11	1.01	0.07	3.79	0.20	13.33	3.36	0.13	12.61	0.27	18.00	5.81	0.17	21.79	0.42	27.67	8.26	0.26	30.98					
0.11	7.11	1.06	0.07	3.98	0.20	13.33	3.41	0.13	12.80	0.27	18.22	5.86	0.17	21.98	0.42	27.67	8.31	0.26	31.17					
0.11	7.11	1.11	0.07	4.17	0.20	13.33	3.46	0.13	12.98	0.28	18.44	5.91	0.17	22.17	0.42	27.67	8.36	0.26	31.36					
0.11	7.56	1.16	0.07	4.36	0.20	13.33	3.51	0.13	13.17	0.28	18.44	5.96	0.17	22.35	0.42	28.00	8.41	0.26	31.54					
0.11	7.56	1.21	0.07	4.55	0.20	13.56	3.56	0.13	13.36	0.28	18.44	6.01	0.17	22.54	0.43	28.33	8.46	0.27	31.73					
0.12	7.78	1.26	0.07	4.74	0.21	13.78	3.61	0.13	13.54	0.28	18.67	6.06	0.18	22.73	0.43	28.33	8.51	0.27	31.92					
0.12	7.78	1.31	0.07	4.92	0.21	14.00	3.66	0.13	13.73	0.28	18.67	6.11	0.18	22.92	0.43	28.33	8.56	0.27	32.11					
0.12	8.22	1.36	0.08	5.11	0.21	14.00	3.71	0.13	13.92	0.28	18.67	6.16	0.18	23.10	0.43	28.33	8.61	0.27	32.29					
0.12	8.22	1.41	0.08	5.30	0.21	14.00	3.76	0.13	14.10	0.28	18.89	6.21	0.18	23.29	0.43	28.33	8.66	0.27	32.48					
0.12	8.22	1.46	0.08	5.48	0.21	14.00	3.81	0.13	14.29	0.29	19.11	6.26	0.18	23.48	0.43	28.33	8.71	0.27	32.67					
0.13	8.44	1.51	0.08	5.67	0.21	14.22	3.86	0.13	14.48	0.29	19.11	6.31	0.18	23.67	0.43	28.33	8.76	0.27	32.86					
0.13	8.89	1.56	0.08	5.86	0.22	14.44	3.91	0.14	14.67	0.29	19.11	6.36	0.18	23.85	0.44	29.00	8.81	0.27	33.04					
0.13	8.89	1.61	0.08	6.04	0.22	14.67	3.96	0.14	14.86	0.29	19.11	6.41	0.18	24.05	0.44	29.00	8.86	0.27	33.23					
0.13	8.89	1.66	0.08	6.23	0.22	14.67	4.01	0.14	15.05	0.29	19.33	6.46	0.18	24.23	0.44	29.00	8.91	0.27	33.42					
0.13	8.89	1.71	0.08	6.42	0.22	14.67	4.06	0.14	15.23	0.29	19.33	6.51	0.18	24.42	0.44	29.00	8.96	0.27	33.61					
0.14	9.56	1.76	0.09	6.61	0.22	14.67	4.11	0.14	15.42	0.29	19.56	6.56	0.18	24.60	0.44	29.00	9.01	0.27	33.80					
0.14	9.56	1.81	0.09	6.79	0.22	14.67	4.16	0.14	15.61	0.30	19.78	6.61	0.19	24.79	0.44	29.00	9.06	0.27	33.98					
0.14	9.56	1.86	0.09	6.98	0.23	15.11	4.21	0.14	15.79	0.30	19.78	6.66	0.19	24.98	0.44	29.00	9.11	0.27	34.17					
0.14	9.56	1.91	0.09	7.17	0.23	15.33	4.26	0.14	15.98	0.30	19.78	6.71	0.19	25.17	0.44	29.00	9.16	0.27	34.36					
0.14	9.56	1.96	0.09	7.36	0.23	15.33	4.31	0.14	16.17	0.30	19.78	6.76	0.19	25.36	0.44	29.33	9.21	0.28	34.55					
0.15	10.22	2.01	0.10	7.54	0.23	15.33	4.36	0.14	16.36	0.30	20.00	6.81	0.19	25.54	0.45	29.67	9.26	0.28	34.73					
0.15	10.22	2.06	0.10	7.73	0.23	15.33	4.41	0.14	16.54	0.30	20.00	6.86	0.19	25.73	0.45	29.67	9.31	0.28	34.92					
0.15	10.22	2.11	0.10	7.92	0.23	15.33	4.46	0.14	16.73	0.30	20.00	6.91	0.19	25.92	0.45	29.67	9.36	0.28	35.11					
0.15	10.22	2.16	0.10	8.11	0.23	15.56	4.51	0.15	16.92	0.39	25.67	6.96	0.24	26.11	0.45	29.67	9.41	0.28	35.30					
0.15	10.22	2.21	0.10	8.29	0.24	16.00	4.56	0.15	17.11	0.39	25.67	7.01	0.24	26.29	0.45	29.67	9.46	0.28	35.48					
0.16	10.67	2.26	0.10	8.48	0.24	16.00	4.61	0.15	17.29	0.39	25.67	7.06	0.24	26.48	0.45	29.67	9.51	0.28	35.67					
0.16	10.89	2.31	0.10	8.67	0.24	16.00	4.66	0.15	17.48	0.39	25.67	7.11	0.24	26.67	0.45	29.67	9.56	0.28	35.86					
					0.24	16.00	4.71	0.15	17.67	0.39	25.67	7.16	0.24	26.86	0.45	30.00	9.61	0.28	36.04					
					0.24	16.00	4.76	0.15	17.86	0.39	26.00	7.21	0.24	27.05										

Appendix 2k- 90day 3-Point Bending Test Data for NTpowder-Composite Composite (Average)

Extension (mm)	Deflection (mm)	Load (KN)	Strain %	Stress (MPa)																				
0.00	0.00	0.01	0.00	0.04	0.12	7.67	2.37	0.07	8.90	0.19	12.67	4.82	0.12	18.09	0.26	17.00	7.27	0.16	27.27	0.32	21.33	9.77	0.20	36.65
0.00	0.00	0.13	0.00	0.47	0.12	7.67	2.42	0.07	9.09	0.19	12.67	4.87	0.12	18.27	0.26	17.33	7.32	0.16	27.46	0.32	21.33	9.82	0.20	36.84
0.00	0.00	0.12	0.00	0.47	0.12	7.67	2.47	0.07	9.28	0.20	13.00	4.92	0.12	18.47	0.26	17.33	7.37	0.16	27.65	0.32	21.33	9.87	0.20	37.03
0.01	0.33	0.17	0.00	0.65	0.12	7.67	2.52	0.07	9.46	0.20	13.00	4.97	0.12	18.65	0.27	17.67	7.42	0.17	27.84	0.33	21.67	9.92	0.20	37.21
0.01	0.33	0.22	0.00	0.83	0.12	8.00	2.57	0.08	9.65	0.20	13.00	5.02	0.12	18.84	0.27	17.67	7.47	0.17	28.03	0.33	22.00	9.97	0.21	37.40
0.02	1.00	0.28	0.01	1.03	0.12	8.00	2.62	0.08	9.84	0.20	13.33	5.07	0.13	19.02	0.27	17.67	7.52	0.17	28.21	0.33	22.00	10.02	0.21	37.59
0.02	1.00	0.32	0.01	1.22	0.12	8.00	2.67	0.08	10.02	0.20	13.33	5.12	0.13	19.22	0.27	17.67	7.57	0.17	28.40	0.33	22.00	10.07	0.21	37.78
0.02	1.33	0.37	0.01	1.40	0.13	8.33	2.72	0.08	10.21	0.20	13.33	5.17	0.13	19.40	0.27	17.67	7.62	0.17	28.59	0.33	22.00	10.12	0.21	37.97
0.03	1.67	0.42	0.02	1.58	0.13	8.33	2.77	0.08	10.40	0.20	13.33	5.22	0.13	19.59	0.27	17.67	7.67	0.17	28.78	0.33	22.00	10.17	0.21	38.15
0.03	1.67	0.47	0.02	1.78	0.13	8.33	2.82	0.08	10.59	0.21	13.67	5.27	0.13	19.77	0.27	18.00	7.72	0.17	28.97	0.33	22.00	10.22	0.21	38.34
0.03	2.00	0.52	0.02	1.97	0.13	8.67	2.87	0.08	10.78	0.21	13.67	5.32	0.13	19.96	0.27	18.00	7.77	0.17	29.15	0.33	22.00	10.27	0.21	38.52
0.04	2.33	0.57	0.02	2.15	0.13	8.67	2.92	0.08	10.96	0.21	13.67	5.37	0.13	20.15	0.28	18.33	7.82	0.17	29.34	0.34	22.33	10.32	0.21	38.72
0.04	2.67	0.63	0.03	2.34	0.13	8.67	2.97	0.08	11.15	0.21	13.67	5.42	0.13	20.34	0.28	18.33	7.87	0.17	29.52	0.34	22.67	10.37	0.21	38.90
0.04	2.67	0.67	0.03	2.53	0.14	9.00	3.02	0.08	11.34	0.21	14.00	5.47	0.13	20.53	0.28	18.33	7.92	0.17	29.72	0.34	22.67	10.42	0.21	39.09
0.04	2.67	0.72	0.03	2.71	0.14	9.00	3.07	0.08	11.52	0.21	14.00	5.52	0.13	20.71	0.28	18.33	7.97	0.17	29.90	0.34	22.67	10.47	0.21	39.28
0.04	2.67	0.77	0.03	2.90	0.14	9.33	3.12	0.09	11.71	0.21	14.00	5.57	0.13	20.90	0.28	18.33	8.02	0.17	30.09	0.34	22.67	10.52	0.21	39.46
0.05	3.33	0.82	0.03	3.09	0.14	9.33	3.17	0.09	11.90	0.22	14.33	5.62	0.13	21.09	0.28	18.67	8.07	0.18	30.28	0.34	22.67	10.57	0.21	39.65
0.05	3.33	0.87	0.03	3.28	0.14	9.33	3.22	0.09	12.09	0.22	14.33	5.67	0.13	21.28	0.28	18.67	8.12	0.18	30.47	0.34	22.67	10.62	0.21	39.84
0.05	3.33	0.92	0.03	3.47	0.14	9.33	3.27	0.09	12.27	0.22	14.33	5.72	0.13	21.46	0.28	18.67	8.17	0.18	30.65	0.34	22.67	10.67	0.21	40.02
0.06	3.67	0.97	0.03	3.65	0.15	9.67	3.32	0.09	12.46	0.22	14.33	5.77	0.13	21.65	0.29	19.00	8.22	0.18	30.84	0.34	22.67	10.72	0.21	40.21
0.06	4.00	1.02	0.04	3.84	0.15	9.67	3.37	0.09	12.65	0.22	14.67	5.82	0.14	21.83	0.29	19.00	8.27	0.18	31.02	0.35	23.33	10.77	0.22	40.40
0.06	4.00	1.07	0.04	4.03	0.15	10.00	3.42	0.09	12.84	0.22	14.67	5.87	0.14	22.03	0.29	19.00	8.32	0.18	31.21	0.35	23.33	10.82	0.22	40.59
0.06	4.00	1.12	0.04	4.21	0.15	10.00	3.47	0.09	13.02	0.23	15.00	5.92	0.14	22.21	0.29	19.00	8.37	0.18	31.40	0.35	23.33	10.87	0.22	40.78
0.07	4.33	1.17	0.04	4.40	0.15	10.00	3.52	0.09	13.22	0.23	15.00	5.97	0.14	22.40	0.29	19.33	8.42	0.18	31.59	0.35	23.33	10.92	0.22	40.96
0.07	4.33	1.22	0.04	4.59	0.15	10.00	3.57	0.09	13.40	0.23	15.00	6.02	0.14	22.59	0.29	19.33	8.47	0.18	31.77	0.35	23.33	10.97	0.22	41.15
0.07	4.67	1.27	0.04	4.78	0.15	10.00	3.62	0.09	13.59	0.23	15.00	6.07	0.14	22.78	0.29	19.33	8.52	0.18	31.96	0.35	23.33	11.02	0.22	41.34
0.07	4.67	1.32	0.04	4.97	0.16	10.33	3.67	0.10	13.77	0.23	15.00	6.12	0.14	22.96	0.29	19.33	8.57	0.18	32.15	0.35	23.33	11.07	0.22	41.53
0.08	5.00	1.37	0.05	5.15	0.16	10.67	3.72	0.10	13.96	0.23	15.00	6.17	0.14	23.15	0.29	19.33	8.62	0.18	32.34	0.36	23.67	11.12	0.22	41.71
0.08	5.00	1.42	0.05	5.34	0.16	10.67	3.77	0.10	14.15	0.23	15.33	6.22	0.14	23.33	0.30	19.67	8.67	0.18	32.53	0.36	23.67	11.17	0.22	41.90
0.08	5.00	1.47	0.05	5.53	0.16	10.67	3.82	0.10	14.34	0.24	15.67	6.27	0.15	23.53	0.30	19.67	8.72	0.18	32.71	0.36	24.00	11.22	0.23	42.09
0.08	5.33	1.52	0.05	5.71	0.16	10.67	3.87	0.10	14.52	0.24	15.67	6.32	0.15	23.72	0.30	19.67	8.77	0.18	32.90	0.36	24.00	11.27	0.23	42.28
0.08	5.33	1.57	0.05	5.90	0.16	10.67	3.92	0.10	14.72	0.24	15.67	6.37	0.15	23.90	0.30	20.00	8.82	0.19	33.09	0.36	24.00	11.32	0.23	42.47
0.09	5.67	1.62	0.05	6.09	0.16	10.67	3.97	0.10	14.90	0.24	15.67	6.42	0.15	24.09	0.30	20.00	8.87	0.19	33.28	0.36	24.00	11.37	0.23	42.65
0.09	5.67	1.67	0.05	6.27	0.17	11.33	4.02	0.11	15.09	0.24	15.67	6.47	0.15	24.28	0.30	20.00	8.92	0.19	33.46	0.36	24.00	11.42	0.23	42.84
0.09	5.67	1.72	0.05	6.46	0.17	11.33	4.07	0.11	15.28	0.24	15.67	6.52	0.15	24.46	0.30	20.00	8.97	0.19	33.65	0.36	24.00	11.47	0.23	43.03
0.09	5.67	1.77	0.05	6.65	0.17	11.33	4.12	0.11	15.46	0.24	15.67	6.57	0.15	24.65	0.30	20.00	9.02	0.19	33.84	0.37	24.33	11.52	0.23	43.21
0.10	6.33	1.82	0.06	6.84	0.17	11.33	4.17	0.11	15.65	0.25	16.33	6.62	0.15	24.83	0.31	20.33	9.07	0.19	34.03	0.38	25.00	11.58	0.23	43.43
0.10	6.33	1.87	0.06	7.02	0.17	11.33	4.22	0.11	15.84	0.25	16.33	6.67	0.15	25.03	0.31	20.33	9.12	0.19	34.21	0.75	49.67	11.61	0.47	43.54
0.10	6.33	1.92	0.06	7.21	0.17	11.33	4.27	0.11	16.03	0.25	16.33	6.72	0.15	25.21	0.31	20.33	9.17	0.19	34.40	0.75	49.67	11.66	0.47	43.73
0.10	6.33	1.97	0.06	7.40	0.18	11.67	4.32	0.11	16.21	0.25	16.33	6.77	0.15	25.40	0.31	20.67	9.22	0.19	34.59	0.75	49.67	11.71	0.47	43.92
0.10	6.33	2.02	0.06	7.59	0.18	12.00	4.37	0.11	16.40	0.25	16.33	6.82	0.15	25.59	0.31	20.67	9.27	0.19	34.78	0.75	49.67	11.76	0.47	44.10
0.11	7.00	2.07	0.07	7.77	0.18	12.00	4.42	0.11	16.59	0.25	16.33	6.87	0.15	25.78	0.31	20.67	9.32	0.19	34.96	0.75	49.67	11.81	0.47	44.29
0.11	7.00	2.12	0.07	7.97	0.18	12.00	4.47	0.11	16.78	0.25	16.33	6.92	0.15	25.97	0.31	20.67	9.37	0.19	35.15	0.77	51.00	6.91	0.48	25.91
0.11	7.00	2.17	0.07	8.15	0.18	12.00	4.52	0.11	16.96	0.25	16.67	6.97	0.16	26.15	0.31	20.67	9.42	0.19	35.34					
0.11	7.00	2.22	0.07	8.33	0.18	12.00	4.57	0.11	17.15	0.26	17.00	7.02	0.16	26.33	0.32	21.00	9.47	0.20	35.53					
0.11	7.00	2.27	0.07	8.53	0.19	12.33	4.62	0.12	17.34	0.26	17.00	7.07	0.16	26.53	0.32	21.00	9.52	0.20	35.71					
0.11	7.33	2.32	0.07	8.72	0.19	12.33	4.67	0.12	17.52	0.26	17.00	7.12	0.16	26.72	0.32	21.33	9.57	0.20	35.90					
					0.19	12.67	4.72	0.12	17.72	0.26	17.00	7.17	0.16	26.90	0.32	21.33	9.62	0.20	36.09					
					0.19	12.67	4.77	0.12	17.90	0.26	17.00	7.22	0.16	27.09	0.32	21.33	9.67	0.20	36.28					
															0.32	21.33	9.72	0.20	36.46					

Appendix 2l- 28day Direct Tensile Test Data for NT00-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)				
0.00	0.00	0.00	0.00	0.29	7.79	0.06	1.11
0.00	0.01	0.00	0.00	0.29	8.26	0.06	1.18
0.00	0.00	0.00	0.00	0.30	8.76	0.06	1.25
0.00	0.00	0.00	0.00	0.33	9.26	0.07	1.32
0.00	0.00	0.00	0.00	0.34	9.75	0.07	1.39
0.00	0.00	0.00	0.00	0.33	10.26	0.07	1.47
0.01	0.00	0.00	0.00	0.34	10.76	0.07	1.54
0.01	0.00	0.00	0.00	0.35	11.28	0.07	1.61
0.01	0.00	0.00	0.00	0.38	11.81	0.08	1.69
0.02	0.00	0.00	0.00	0.38	12.34	0.08	1.76
0.02	0.00	0.00	0.00	0.39	12.86	0.08	1.84
0.03	0.00	0.01	0.00	0.40	13.40	0.08	1.91
0.03	0.00	0.01	0.00	0.39	13.90	0.08	1.99
0.03	0.00	0.01	0.00	0.43	14.43	0.09	2.06
0.05	0.01	0.01	0.00	0.43	14.96	0.09	2.14
0.05	0.01	0.01	0.00	0.44	15.47	0.09	2.21
0.05	0.01	0.01	0.00	0.45	15.99	0.09	2.28
0.06	0.02	0.01	0.00	0.45	12.78	0.09	1.83
0.07	0.04	0.01	0.01	0.46	13.38	0.09	1.91
0.07	0.05	0.01	0.01	0.48	13.97	0.10	2.00
0.08	0.09	0.02	0.01	0.49	14.56	0.10	2.08
0.08	0.14	0.02	0.02	0.50	15.14	0.10	2.16
0.09	0.21	0.02	0.03	0.50	15.67	0.10	2.24
0.10	0.29	0.02	0.04	0.51	16.20	0.10	2.31
0.11	0.38	0.02	0.05	0.55	16.68	0.11	2.38
0.11	0.47	0.02	0.07	0.56	17.15	0.11	2.45
0.11	0.58	0.02	0.08	0.55	17.61	0.11	2.52
0.13	0.71	0.03	0.10	0.56	18.09	0.11	2.58
0.13	0.88	0.03	0.13	0.57	18.58	0.11	2.65
0.14	1.07	0.03	0.15	0.57	19.04	0.11	2.72
0.14	1.27	0.03	0.18	0.61	19.51	0.12	2.79
0.16	1.52	0.03	0.22	0.62	19.96	0.12	2.85
0.17	1.81	0.03	0.26	0.63	20.40	0.13	2.91
0.17	2.14	0.03	0.31	0.62	20.85	0.12	2.98
0.17	2.48	0.03	0.35	0.63	21.25	0.13	3.04
0.18	2.81	0.04	0.40	0.64	21.63	0.13	3.09
0.20	3.15	0.04	0.45	0.68	21.94	0.14	3.13
0.21	3.53	0.04	0.50	0.68	22.10	0.14	3.16
0.21	3.90	0.04	0.56	0.69	21.48	0.14	3.07
0.21	4.28	0.04	0.61				
0.23	4.68	0.05	0.67				
0.24	5.08	0.05	0.73				
0.25	5.49	0.05	0.78				
0.25	5.93	0.05	0.85				
0.26	6.38	0.05	0.91				
0.28	6.84	0.06	0.98				
0.28	7.32	0.06	1.05				

Appendix 2m- 28day Direct Tensile Test Data for NT0.5-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.00	0.00	0.00	0.00	0.02	5.67	0.04	0.81	0.04	11.74	0.07	1.68	0.05	16.81	0.10	2.40
0.00	0.02	0.00	0.00	0.02	5.77	0.04	0.82	0.04	11.85	0.07	1.69	0.05	16.88	0.10	2.41
0.00	0.03	0.01	0.00	0.02	5.90	0.04	0.84	0.04	11.97	0.07	1.71	0.05	16.92	0.10	2.42
0.00	0.04	0.01	0.01	0.02	5.95	0.05	0.85	0.04	12.20	0.08	1.74	0.05	17.08	0.10	2.44
0.00	0.06	0.01	0.01	0.02	6.18	0.05	0.88	0.04	12.37	0.08	1.77	0.05	17.19	0.10	2.46
0.00	0.10	0.01	0.01	0.02	6.24	0.05	0.89	0.04	12.42	0.08	1.77	0.05	17.27	0.10	2.47
0.01	0.14	0.01	0.02	0.02	6.41	0.05	0.92	0.04	12.49	0.08	1.78	0.05	17.39	0.11	2.48
0.01	0.17	0.01	0.02	0.02	6.53	0.05	0.93	0.04	12.54	0.08	1.79	0.05	17.44	0.11	2.49
0.01	0.25	0.01	0.04	0.03	6.64	0.05	0.95	0.04	12.66	0.08	1.81	0.05	17.51	0.11	2.50
0.01	0.61	0.01	0.09	0.03	6.70	0.05	0.96	0.04	12.75	0.08	1.82	0.05	17.58	0.11	2.51
0.01	0.76	0.01	0.11	0.03	6.90	0.05	0.99	0.04	12.89	0.08	1.84	0.05	17.66	0.11	2.52
0.01	0.81	0.01	0.12	0.03	6.93	0.05	0.99	0.04	13.06	0.08	1.87	0.06	17.71	0.11	2.53
0.01	1.02	0.01	0.15	0.03	7.10	0.05	1.01	0.04	13.17	0.08	1.88	0.06	17.88	0.11	2.55
0.01	1.09	0.02	0.16	0.03	7.27	0.05	1.04	0.04	12.34	0.08	1.76	0.06	17.91	0.11	2.56

(continued on next page)

(*continued*)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.01	1.14	0.02	0.16	0.03	7.33	0.05	1.05	0.04	13.40	0.08	1.91	0.06	18.01	0.11	2.57
0.01	1.20	0.02	0.17	0.03	7.44	0.05	1.06	0.04	13.52	0.08	1.93	0.06	18.28	0.11	2.61
0.01	1.25	0.01	0.18	0.03	7.56	0.06	1.08	0.04	13.63	0.08	1.95	0.06	18.33	0.11	2.62
0.01	1.31	0.02	0.19	0.03	7.67	0.06	1.10	0.04	13.69	0.08	1.96	0.06	18.41	0.11	2.63
0.01	1.43	0.02	0.20	0.03	7.73	0.06	1.10	0.04	13.80	0.08	1.97	0.06	18.55	0.11	2.65
0.01	1.61	0.02	0.23	0.03	7.84	0.06	1.12	0.04	14.01	0.08	2.00	0.06	18.59	0.12	2.66
0.01	1.72	0.02	0.25	0.03	7.92	0.06	1.13	0.04	14.18	0.09	2.03	0.06	18.61	0.12	2.66
0.01	1.83	0.02	0.26	0.03	8.07	0.06	1.15	0.04	14.19	0.09	2.03	0.06	18.65	0.12	2.66
0.01	1.94	0.02	0.28	0.03	8.13	0.06	1.16	0.04	14.25	0.09	2.04	0.06	18.71	0.12	2.67
0.01	2.06	0.02	0.29	0.03	8.30	0.06	1.19	0.04	14.31	0.09	2.04	0.06	18.77	0.12	2.68
0.01	2.44	0.02	0.35	0.03	8.47	0.06	1.21	0.04	14.44	0.08	2.06	0.06	18.91	0.12	2.70
0.01	2.57	0.03	0.37	0.03	8.55	0.06	1.22	0.04	14.51	0.08	2.07	0.06	19.01	0.12	2.72
0.01	2.63	0.03	0.38	0.03	8.70	0.06	1.24	0.04	14.55	0.08	2.08	0.06	19.14	0.12	2.73
0.01	2.80	0.03	0.40	0.03	8.82	0.06	1.26	0.04	14.63	0.08	2.09	0.06	19.22	0.12	2.75
0.01	3.03	0.03	0.43	0.03	8.88	0.06	1.27	0.04	14.67	0.08	2.10	0.06	19.28	0.12	2.75
0.02	2.97	0.03	0.42	0.03	8.93	0.06	1.28	0.04	14.76	0.09	2.11	0.06	19.41	0.12	2.77
0.02	3.31	0.03	0.47	0.03	9.10	0.06	1.30	0.04	14.81	0.09	2.12	0.06	19.55	0.12	2.79
0.02	3.43	0.03	0.49	0.03	9.22	0.06	1.32	0.04	14.93	0.09	2.13	0.06	19.61	0.12	2.80
0.02	3.67	0.03	0.52	0.03	9.33	0.06	1.33	0.04	15.10	0.09	2.16	0.06	19.77	0.12	2.82
0.02	3.72	0.03	0.53	0.03	9.45	0.06	1.35	0.05	15.29	0.09	2.18	0.06	19.83	0.12	2.83
0.02	3.89	0.03	0.56	0.03	9.56	0.06	1.37	0.05	15.41	0.09	2.20	0.06	19.98	0.12	2.85
0.02	4.06	0.03	0.58	0.03	9.74	0.06	1.39	0.05	15.62	0.09	2.23	0.06	20.10	0.12	2.87
0.02	4.24	0.03	0.61	0.03	9.91	0.07	1.42	0.05	15.78	0.09	2.25	0.06	20.29	0.12	2.90
0.02	4.41	0.04	0.63	0.03	10.08	0.07	1.44	0.05	15.84	0.09	2.26	0.06	20.48	0.12	2.93
0.02	4.69	0.04	0.67	0.03	10.31	0.07	1.47	0.05	15.97	0.09	2.28	0.06	20.66	0.13	2.95
0.02	4.81	0.04	0.69	0.03	10.36	0.07	1.48	0.05	16.21	0.09	2.32	0.06	20.85	0.13	2.98
0.02	4.92	0.04	0.70	0.03	10.53	0.07	1.50	0.05	16.27	0.10	2.32	0.06	21.04	0.13	3.01
0.02	5.03	0.04	0.72	0.03	10.77	0.07	1.54	0.05	16.31	0.10	2.33	0.06	21.23	0.13	3.03
0.02	5.10	0.04	0.73	0.03	10.94	0.07	1.56	0.05	16.38	0.10	2.34	0.06	21.41	0.13	3.06
0.02	5.15	0.04	0.74	0.04	11.01	0.07	1.57	0.05	16.49	0.10	2.36	0.06	21.60	0.13	3.09
0.02	5.20	0.04	0.74	0.04	11.17	0.07	1.60	0.05	16.52	0.10	2.36	0.06	21.79	0.13	3.11
0.02	5.38	0.04	0.77	0.04	11.28	0.07	1.61	0.05	16.59	0.10	2.37	0.07	21.98	0.13	3.14
0.02	5.49	0.04	0.78	0.04	11.34	0.07	1.62	0.05	16.63	0.10	2.38	0.07	22.16	0.13	3.17
0.02	5.55	0.04	0.79	0.04	11.45	0.07	1.64	0.05	16.70	0.10	2.39	0.07	22.35	0.13	3.19
				0.04	11.68	0.07	1.67	0.05	16.76	0.10	2.39	0.07	22.51	0.13	3.22
0.07	22.73	0.13	3.25	0.08	32.55	0.16	4.65	1.23	40.28	2.47	5.75	3.42	27.11	6.83	3.87
0.07	22.91	0.13	3.27	0.08	32.86	0.16	4.69	1.25	40.36	2.50	5.77	3.43	27.01	6.87	3.86
0.07	23.10	0.13	3.30	0.08	33.18	0.16	4.74	1.64	40.54	3.29	5.79	3.45	26.99	6.90	3.86
0.07	23.28	0.13	3.33	0.08	33.23	0.16	4.75	1.67	40.57	3.35	5.80	3.47	26.94	6.93	3.85
0.07	23.48	0.13	3.35	0.08	33.60	0.16	4.80	1.79	40.63	3.58	5.80	3.48	26.87	6.97	3.84
0.07	23.67	0.13	3.38	0.08	33.79	0.16	4.83	1.89	40.71	3.78	5.82	3.50	26.76	7.00	3.82
0.07	23.86	0.13	3.41	0.08	33.98	0.16	4.85	1.91	40.78	3.82	5.83	3.52	26.55	7.03	3.79
0.07	24.04	0.14	3.43	0.08	34.19	0.16	4.88	2.02	40.84	4.04	5.83	3.53	26.53	7.07	3.79
0.07	24.23	0.14	3.46	0.08	34.34	0.16	4.91	2.00	40.91	4.00	5.84	3.55	26.44	7.10	3.78
0.07	24.60	0.14	3.51	0.08	34.56	0.16	4.94	2.23	40.98	4.46	5.85	3.57	26.01	7.13	3.72
0.07	25.17	0.14	3.60	0.08	34.77	0.16	4.97	2.33	41.22	4.66	5.89	3.58	25.88	7.17	3.70
0.07	25.36	0.14	3.62	0.08	34.91	0.16	4.99	2.35	41.28	4.70	5.90	3.60	25.86	7.20	3.69
0.07	24.79	0.14	3.54	0.08	35.10	0.17	5.01	2.41	41.34	4.82	5.91	3.62	25.78	7.23	3.68
0.07	24.98	0.14	3.57	0.08	35.29	0.17	5.04	2.47	40.39	4.94	5.77	3.63	25.65	7.27	3.66
0.07	25.54	0.14	3.65	0.08	35.66	0.17	5.09	2.53	40.01	5.07	5.72	3.65	25.61	7.30	3.66
0.07	25.73	0.14	3.68	0.08	35.88	0.17	5.13	2.58	39.98	5.15	5.71	3.67	25.59	7.33	3.66
0.07	25.92	0.14	3.70	0.09	35.93	0.17	5.13	2.61	39.86	5.22	5.69	3.68	25.41	7.37	3.63
0.07	26.44	0.14	3.78	0.09	36.11	0.17	5.16	2.66	39.57	5.32	5.65	3.70	25.30	7.40	3.61
0.07	26.65	0.14	3.81	0.09	36.23	0.17	5.18	2.72	39.21	5.43	5.60	3.72	25.21	7.43	3.60
0.07	26.84	0.14	3.83	0.09	36.44	0.18	5.21	2.77	39.01	5.54	5.57	3.73	25.01	7.47	3.57
0.07	26.11	0.14	3.73	0.09	36.55	0.18	5.22	2.83	38.91	5.66	5.56	3.75	24.98	7.50	3.57
0.07	26.39	0.15	3.77	0.09	36.71	0.18	5.24	2.89	38.67	5.78	5.52	3.77	24.81	7.53	3.54
0.07	27.01	0.15	3.86	0.09	36.78	0.18	5.25	2.92	38.23	5.84	5.46	3.78	24.78	7.57	3.54
0.07	27.13	0.15	3.88	0.09	36.82	0.18	5.26	2.98	37.89	5.96	5.41	3.80	24.67	7.60	3.52
0.07	27.42	0.15	3.92	0.09	36.86	0.18	5.27	3.00	37.61	6.00	5.37	3.82	24.55	7.63	3.51
0.07	27.61	0.15	3.94	0.09	37.09	0.18	5.30	3.02	37.11	6.03	5.30	3.83	24.43	7.67	3.49
0.07	27.79	0.15	3.97	0.09	37.22	0.19	5.32	3.03	36.54	6.07	5.22	3.85	24.31	7.70	3.47
0.07	28.18	0.15	4.03	0.09	36.89	0.19	5.27	3.05	36.01	6.10	5.14	3.87	24.22	7.73	3.46
0.07	28.26	0.15	4.04	0.09	37.25	0.19	5.32	3.07	35.22	6.13	5.03	3.88	24.15	7.77	3.45
0.08	28.54	0.15	4.08	0.10	36.91	0.19	5.27	3.08	35.02	6.17	5.00				
0.08	29.15	0.15	4.16	0.10	37.33	0.19	5.33	3.10	34.78	6.20	4.97				
0.08	29.33	0.15	4.19	0.10	37.41	0.19	5.34	3.12	34.38	6.23	4.91				
0.08	28.73	0.15	4.10	0.10	37.55	0.20	5.36	3.13	34.13	6.27	4.88				
0.08	28.91	0.15	4.13	1.00	37.66	2.00	5.38	3.15	33.21	6.30	4.74				

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)								
0.08	29.44	0.15	4.21	1.02	37.71	2.03	5.39	3.17	33.07	6.33	4.72
0.08	29.87	0.15	4.27	1.02	37.83	2.05	5.40	3.18	32.76	6.37	4.68
0.08	30.08	0.15	4.30	1.03	38.33	2.07	5.48	3.20	32.09	6.40	4.58
0.08	30.23	0.15	4.32	1.05	37.82	2.09	5.40	3.22	31.98	6.43	4.57
0.08	30.60	0.15	4.37	1.05	37.91	2.10	5.42	3.23	31.87	6.47	4.55
0.08	30.45	0.15	4.35	1.07	38.21	2.13	5.46	3.25	31.66	6.50	4.52
0.08	30.87	0.15	4.41	1.08	38.48	2.17	5.50	3.27	31.51	6.53	4.50
0.08	30.97	0.15	4.42	1.10	38.51	2.20	5.50	3.28	31.01	6.57	4.43
0.08	31.18	0.16	4.45	1.12	38.56	2.23	5.51	3.30	29.89	6.60	4.27
0.08	31.37	0.16	4.48	1.13	38.66	2.27	5.52	3.32	29.77	6.63	4.25
0.08	31.63	0.16	4.52	1.15	38.71	2.30	5.53	3.33	29.54	6.67	4.22
0.08	31.77	0.16	4.54	1.17	38.77	2.33	5.54	3.35	29.22	6.70	4.17
0.08	31.98	0.16	4.57	1.18	38.81	2.37	5.54	3.37	28.10	6.73	4.01
0.08	32.13	0.16	4.59	1.20	38.99	2.40	5.57	3.38	27.88	6.77	3.98
0.08	32.42	0.16	4.63	1.22	40.21	2.43	5.74	3.40	27.33	6.80	3.90

Appendix 2p- 28day Direct Tensile Test Data for NT1.0-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.000	0.00	0.00	0.00	0.024	4.82	0.05	0.69	0.060	9.98	0.12	1.43	0.362	14.29	0.72	2.04
0.000	0.03	0.00	0.00	0.024	4.91	0.05	0.70	0.068	10.07	0.14	1.44	0.365	14.35	0.73	2.05
0.000	0.07	0.00	0.01	0.024	5.01	0.05	0.72	0.072	10.17	0.14	1.45	0.367	14.38	0.73	2.05
0.000	0.13	0.00	0.02	0.024	5.06	0.05	0.72	0.078	10.37	0.16	1.48	0.372	14.52	0.74	2.07
0.000	0.20	0.00	0.03	0.024	5.25	0.05	0.75	0.083	10.51	0.17	1.50	0.375	14.61	0.75	2.09
0.000	0.25	0.00	0.04	0.024	5.30	0.05	0.76	0.085	10.56	0.17	1.51	0.381	14.68	0.76	2.10
0.000	0.32	0.00	0.05	0.024	5.44	0.05	0.78	0.091	10.62	0.18	1.52	0.384	14.78	0.77	2.11
0.000	0.36	0.00	0.05	0.024	5.55	0.05	0.79	0.100	10.66	0.20	1.52	0.387	14.82	0.77	2.12
0.000	0.41	0.00	0.06	0.024	5.64	0.05	0.81	0.116	10.76	0.23	1.54	0.401	14.88	0.80	2.13
0.000	0.44	0.00	0.06	0.024	5.69	0.05	0.81	0.118	10.84	0.24	1.55	0.415	14.94	0.83	2.13
0.000	0.51	0.00	0.07	0.024	5.86	0.05	0.84	0.138	10.96	0.28	1.57	0.418	15.01	0.84	2.14
0.010	0.58	0.02	0.08	0.024	5.89	0.05	0.84	0.141	11.10	0.28	1.59	0.422	15.05	0.84	2.15
0.015	0.61	0.03	0.09	0.024	6.04	0.05	0.86	0.152	11.19	0.30	1.60	0.427	15.20	0.85	2.17
0.020	0.66	0.04	0.09	0.024	6.18	0.05	0.88	0.158	10.49	0.32	1.50	0.430	15.22	0.86	2.17
0.020	0.86	0.04	0.12	0.024	6.23	0.05	0.89	0.164	11.39	0.33	1.63	0.438	15.31	0.88	2.19
0.020	0.90	0.04	0.13	0.024	6.32	0.05	0.90	0.169	11.49	0.34	1.64	0.440	15.54	0.88	2.22
0.020	0.94	0.04	0.13	0.024	6.43	0.05	0.92	0.171	11.59	0.34	1.66	0.443	15.58	0.89	2.23
0.020	0.98	0.04	0.14	0.024	6.52	0.05	0.93	0.173	11.64	0.35	1.66	0.449	15.65	0.90	2.24
0.020	1.07	0.04	0.15	0.024	6.57	0.05	0.94	0.175	11.73	0.35	1.68	0.452	15.77	0.90	2.25
0.021	1.20	0.04	0.17	0.024	6.66	0.05	0.95	0.179	11.91	0.36	1.70	0.458	15.80	0.92	2.26
0.021	1.37	0.04	0.20	0.024	6.73	0.05	0.96	0.180	12.05	0.36	1.72	0.461	15.82	0.92	2.26
0.021	1.46	0.04	0.21	0.024	6.86	0.05	0.98	0.182	12.06	0.36	1.72	0.461	15.85	0.92	2.26
0.021	1.55	0.04	0.22	0.024	6.91	0.05	0.99	0.188	12.11	0.38	1.73	0.462	15.90	0.92	2.27
0.021	1.65	0.04	0.24	0.025	7.06	0.05	1.01	0.213	12.16	0.43	1.74	0.462	15.95	0.92	2.28
0.021	1.95	0.04	0.28	0.025	7.20	0.05	1.03	0.218	12.27	0.44	1.75	0.463	16.07	0.93	2.30
0.022	2.06	0.04	0.29	0.025	7.27	0.05	1.04	0.220	12.33	0.44	1.76	0.464	16.16	0.93	2.31
0.230	2.11	0.46	0.30	0.025	7.40	0.05	1.06	0.224	12.37	0.45	1.77	0.464	16.27	0.93	2.32
0.023	2.24	0.05	0.32	0.025	7.49	0.05	1.07	0.229	12.44	0.46	1.78	0.465	16.34	0.93	2.33
0.023	2.42	0.05	0.35	0.025	7.54	0.05	1.08	0.230	12.47	0.46	1.78	0.466	16.39	0.93	2.34
0.023	2.38	0.05	0.34	0.025	7.59	0.05	1.08	0.241	12.55	0.48	1.79	0.466	16.50	0.93	2.36
0.023	2.82	0.05	0.40	0.025	7.74	0.05	1.11	0.248	12.59	0.50	1.80	0.467	16.62	0.93	2.37
0.023	2.91	0.05	0.42	0.025	7.84	0.05	1.12	0.251	12.69	0.50	1.81	0.467	16.67	0.93	2.38
0.023	3.12	0.05	0.45	0.025	7.93	0.05	1.13	0.256	12.84	0.51	1.83	0.467	16.80	0.93	2.40
0.023	3.16	0.05	0.45	0.025	8.03	0.05	1.15	0.259	13.00	0.52	1.86	0.468	16.86	0.94	2.41
0.023	3.31	0.05	0.47	0.025	8.13	0.05	1.16	0.300	13.10	0.60	1.87	0.468	16.98	0.94	2.43
0.023	3.45	0.05	0.49	0.025	8.28	0.05	1.18	0.312	13.28	0.62	1.90	0.472	17.09	0.94	2.44
0.023	3.60	0.05	0.51	0.025	8.42	0.05	1.20	0.314	13.41	0.63	1.92	0.474	17.25	0.95	2.46
0.023	3.75	0.05	0.54	0.032	8.57	0.06	1.22	0.318	13.46	0.64	1.92	0.478	17.41	0.96	2.49
0.023	3.99	0.05	0.57	0.032	8.76	0.06	1.25	0.319	13.57	0.64	1.94	0.482	17.56	0.96	2.51
0.023	4.09	0.05	0.58	0.032	8.81	0.06	1.26	0.322	13.78	0.64	1.97	0.488	17.72	0.98	2.53
0.023	4.18	0.05	0.60	0.032	8.95	0.06	1.28	0.324	13.83	0.65	1.98	0.501	17.88	1.00	2.55
0.024	4.28	0.05	0.61	0.032	9.15	0.06	1.31	0.326	13.86	0.65	1.98	0.511	18.05	1.02	2.58
0.024	4.33	0.05	0.62	0.040	9.30	0.08	1.33	0.331	13.92	0.66	1.99	0.518	18.20	1.04	2.60
0.024	4.38	0.05	0.63	0.048	9.36	0.10	1.34	0.338	14.02	0.68	2.00	0.520	18.36	1.04	2.62
0.024	4.42	0.05	0.63	0.055	9.49	0.11	1.36	0.345	14.04	0.69	2.01	0.520	18.52	1.04	2.65
0.024	4.57	0.05	0.65	0.058	9.59	0.12	1.37	0.348	14.10	0.70	2.01	0.520	18.68	1.04	2.67
0.024	4.67	0.05	0.67	0.060	9.64	0.12	1.38	0.353	14.14	0.71	2.02	0.520	18.84	1.04	2.69

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.024	4.72	0.05	0.67	0.060	9.73	0.12	1.39	0.355	14.20	0.71	2.03	0.520	19.00	1.04	2.71
				0.060	9.93	0.12	1.42	0.358	14.25	0.72	2.04	0.520	19.13	1.04	2.73
0.522	19.32	1.04	2.76	0.816	27.67	1.63	3.95	1.600	34.24	3.20	4.89	3.592	23.04	7.18	3.29
0.522	19.47	1.04	2.78	0.816	27.93	1.63	3.99	1.650	34.31	3.30	4.90	3.592	22.96	7.18	3.28
0.522	19.64	1.04	2.81	0.816	28.20	1.63	4.03	1.820	34.46	3.64	4.92	3.592	22.94	7.18	3.28
0.522	19.79	1.04	2.83	0.816	28.25	1.63	4.04	2.080	34.48	4.16	4.93	3.612	22.90	7.22	3.27
0.522	19.96	1.04	2.85	0.816	28.56	1.63	4.08	2.180	34.54	4.36	4.93	3.612	22.84	7.22	3.26
0.522	20.12	1.04	2.87	0.816	28.72	1.63	4.10	2.250	34.60	4.50	4.94	3.612	22.75	7.22	3.25
0.526	20.28	1.05	2.90	0.882	28.88	1.76	4.13	2.350	34.66	4.70	4.95	3.612	22.57	7.22	3.22
0.526	20.43	1.05	2.92	0.882	29.06	1.76	4.15	2.380	34.71	4.76	4.96	3.624	22.55	7.25	3.22
0.526	20.60	1.05	2.94	0.882	29.19	1.76	4.17	2.420	34.77	4.84	4.97	3.624	22.47	7.25	3.21
0.526	20.91	1.05	2.99	0.882	29.38	1.76	4.20	2.460	34.83	4.92	4.98	3.624	22.11	7.25	3.16
0.526	21.39	1.05	3.06	0.882	29.55	1.76	4.22	2.480	35.04	4.96	5.01	3.624	22.00	7.25	3.14
0.526	21.56	1.05	3.08	0.882	29.67	1.76	4.24	2.520	35.09	5.04	5.01	3.626	21.98	7.25	3.14
0.530	21.07	1.06	3.01	0.893	29.84	1.79	4.26	2.760	35.14	5.52	5.02	3.626	21.91	7.25	3.13
0.530	21.23	1.06	3.03	0.893	30.00	1.79	4.29	2.830	34.33	5.66	4.90	3.626	21.80	7.25	3.11
0.530	21.71	1.06	3.10	0.893	30.31	1.79	4.33	2.940	34.01	5.88	4.86	3.626	21.77	7.25	3.11
0.530	21.87	1.06	3.12	0.893	30.50	1.79	4.36	3.200	33.98	6.40	4.85	3.626	21.75	7.25	3.11
0.530	22.03	1.06	3.15	0.893	30.54	1.79	4.36	3.220	33.88	6.44	4.84	3.626	21.60	7.25	3.09
0.530	22.47	1.06	3.21	0.893	30.69	1.79	4.38	3.240	33.63	6.48	4.80	3.628	21.51	7.26	3.07
0.552	22.65	1.10	3.24	0.893	30.80	1.79	4.40	3.260	33.33	6.52	4.76	3.628	21.43	7.26	3.06
0.552	22.81	1.10	3.26	0.912	30.97	1.82	4.42	3.270	33.16	6.54	4.74	3.628	21.26	7.26	3.04
0.552	22.19	1.10	3.17	0.912	31.07	1.82	4.44	3.320	33.07	6.64	4.72	3.628	21.23	7.26	3.03
0.552	22.43	1.10	3.20	0.912	31.20	1.82	4.46	3.340	32.87	6.68	4.70	3.628	21.09	7.26	3.01
0.552	22.96	1.10	3.28	0.912	31.26	1.82	4.47	3.380	32.50	6.76	4.64	3.628	21.06	7.26	3.01
0.552	23.06	1.10	3.29	0.912	31.30	1.82	4.47	3.420	32.21	6.84	4.60	3.631	20.97	7.26	3.00
0.552	23.31	1.10	3.33	1.150	31.33	2.30	4.48	3.450	31.97	6.90	4.57	3.631	20.87	7.26	2.98
0.610	23.47	1.22	3.35	1.150	31.53	2.30	4.50	3.520	31.54	7.04	4.51	3.631	20.77	7.26	2.97
0.610	23.62	1.22	3.37	1.150	31.64	2.30	4.52	3.550	31.06	7.10	4.44	3.635	20.66	7.27	2.95
0.610	23.95	1.22	3.42	1.150	31.36	2.30	4.48	3.570	30.61	7.14	4.37	3.635	20.59	7.27	2.94
0.610	24.02	1.22	3.43	1.150	31.66	2.30	4.52	3.571	29.94	7.14	4.28	3.635	20.53	7.27	2.93
0.610	24.26	1.22	3.47	1.150	31.37	2.30	4.48	3.572	29.77	7.14	4.25				
0.610	24.78	1.22	3.54	1.220	31.73	2.44	4.53	3.573	29.56	7.15	4.22				
0.610	24.93	1.22	3.56	1.220	31.80	2.44	4.54	3.754	29.22	7.51	4.17				
0.660	24.42	1.32	3.49	1.220	31.92	2.44	4.56	3.575	29.01	7.15	4.14				
0.660	24.57	1.32	3.51	1.220	32.01	2.44	4.57	3.582	28.23	7.16	4.03				
0.660	25.02	1.32	3.57	1.220	32.05	2.44	4.58	3.582	28.11	7.17	4.02				
0.660	25.39	1.32	3.63	1.220	32.16	2.44	4.59	3.582	27.85	7.16	3.98				
0.660	25.57	1.32	3.65	1.220	32.58	2.44	4.65	3.582	27.28	7.18	3.90				
0.660	25.70	1.32	3.67	1.260	32.15	2.52	4.59	3.583	27.18	7.18	3.88				
0.680	26.01	1.36	3.72	1.320	32.22	2.64	4.60	3.583	27.09	7.18	3.87				
0.680	25.88	1.36	3.70	1.342	32.48	2.68	4.64	3.583	26.91	7.18	3.84				
0.680	26.24	1.36	3.75	1.350	32.71	2.70	4.67	3.583	26.78	7.18	3.83				
0.680	26.32	1.36	3.76	1.360	32.73	2.72	4.68	3.583	26.36	7.18	3.77				
0.680	26.50	1.36	3.79	1.380	32.78	2.76	4.68	3.585	25.41	7.17	3.63				
0.680	26.66	1.36	3.81	1.400	32.86	2.80	4.69	3.585	25.30	7.17	3.61				
0.712	26.89	1.42	3.84	1.410	32.90	2.82	4.70	3.585	25.11	7.17	3.59				
0.712	27.00	1.42	3.86	1.420	32.95	2.84	4.71	3.585	24.84	7.17	3.55				
0.712	27.18	1.42	3.88	1.430	32.99	2.86	4.71	3.592	23.89	7.18	3.41				
0.712	27.31	1.42	3.90	1.440	33.14	2.88	4.73	3.592	23.70	7.18	3.39				
0.712	27.56	1.42	3.94	1.550	34.18	3.10	4.88	3.592	23.23	7.18	3.32				

Appendix 2q- 28day Direct Tensile Test Data for NTpowder-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.00	0.00	0.00	0.00	2.45	0.51	1.02	0.35	10.24	0.93	1.86	1.46	16.45	1.18	2.36	2.35
0.11	0.00	0.00	0.02	2.55	0.52	1.05	0.36	10.26	0.93	1.86	1.47	16.54	1.18	2.37	2.36
0.11	0.00	0.00	0.02	2.61	0.54	1.07	0.37	10.47	0.94	1.88	1.50	16.65	1.19	2.37	2.38
0.18	0.10	0.20	0.03	2.78	0.55	1.10	0.40	10.64	0.95	1.90	1.52	16.77	1.19	2.38	2.40
0.17	0.10	0.20	0.03	2.95	0.56	1.13	0.42	10.62	0.96	1.91	1.52	16.88	1.20	2.39	2.41
0.27	0.11	0.23	0.04	3.07	0.58	1.16	0.44	11.04	0.96	1.93	1.58	17.00	1.20	2.40	2.43
0.17	0.11	0.23	0.02	3.30	0.60	1.20	0.47	11.09	0.97	1.94	1.58	17.11	1.20	2.41	2.44
0.27	0.11	0.23	0.04	3.47	0.62	1.23	0.50	11.20	0.97	1.94	1.60	17.17	1.21	2.41	2.45
0.32	0.11	0.23	0.05	3.58	0.66	1.31	0.51	11.38	0.98	1.96	1.63	17.28	1.21	2.42	2.47
0.38	0.11	0.23	0.05	3.64	0.66	1.31	0.52	11.55	0.99	1.98	1.65	17.38	1.21	2.43	2.48
0.39	0.12	0.23	0.06	3.76	0.66	1.32	0.54	11.78	1.00	1.99	1.68	17.42	1.22	2.43	2.49

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.44	0.12	0.24	0.06	3.87	0.66	1.32	0.55	12.07	1.01	2.02	1.72	17.57	1.22	2.44	2.51
0.49	0.12	0.24	0.07	4.04	0.66	1.32	0.58	12.24	1.02	2.03	1.75	17.68	1.22	2.45	2.53
0.55	0.20	0.40	0.08	4.10	0.67	1.33	0.59	12.53	1.02	2.04	1.79	17.79	1.23	2.45	2.54
0.67	0.22	0.44	0.10	4.28	0.68	1.35	0.61	12.59	1.03	2.06	1.80	17.91	1.23	2.47	2.56
0.67	0.25	0.50	0.10	4.45	0.68	1.37	0.64	12.81	1.04	2.08	1.83	18.02	1.24	2.47	2.57
0.78	0.26	0.53	0.11	4.56	0.69	1.38	0.65	13.10	1.05	2.10	1.87	18.09	1.24	2.48	2.58
0.84	0.33	0.66	0.12	4.74	0.70	1.39	0.68	13.33	1.06	2.12	1.90	18.26	1.24	2.49	2.61
0.90	0.36	0.72	0.13	4.91	0.71	1.41	0.70	13.61	1.07	2.14	1.94	18.37	1.25	2.50	2.62
0.95	0.38	0.76	0.14	5.02	0.71	1.42	0.72	13.73	1.08	2.15	1.96	18.48	1.25	2.50	2.64
1.01	0.39	0.79	0.14	5.19	0.72	1.44	0.74	13.84	1.08	2.16	1.98	18.60	1.26	2.51	2.66
1.10	0.40	0.79	0.16	5.31	0.72	1.45	0.76	13.90	1.08	2.17	1.99	18.72	1.26	2.52	2.67
1.18	0.31	0.62	0.17	5.42	0.73	1.45	0.77	13.94	1.08	2.17	1.99	18.77	1.26	2.52	2.68
1.24	0.34	0.67	0.18	5.54	0.73	1.46	0.79	13.96	1.09	2.17	1.99	18.89	1.27	2.53	2.70
1.29	0.35	0.69	0.18	5.76	0.73	1.47	0.82	14.02	1.09	2.18	2.00	19.00	1.27	2.54	2.71
1.24	0.35	0.69	0.18	5.94	0.74	1.48	0.85	14.07	1.09	2.18	2.01	19.06	1.27	2.54	2.72
1.30	0.35	0.70	0.19	6.11	0.76	1.51	0.87	14.19	1.09	2.19	2.03	19.17	1.28	2.55	2.74
1.18	0.36	0.72	0.17	6.28	0.76	1.53	0.90	14.30	1.10	2.20	2.04	19.34	1.28	2.56	2.76
1.24	0.36	0.72	0.18	6.40	0.77	1.54	0.91	14.36	1.10	2.20	2.05	19.40	1.28	2.56	2.77
1.18	0.36	0.72	0.17	6.51	0.77	1.55	0.93	14.47	1.11	2.21	2.07	19.51	1.29	2.57	2.79
1.36	0.36	0.72	0.19	6.68	0.78	1.56	0.95	14.59	1.11	2.22	2.08	19.68	1.29	2.59	2.81
1.41	0.37	0.73	0.20	6.80	0.79	1.57	0.97	14.70	1.11	2.23	2.10	19.86	1.30	2.60	2.84
1.24	0.37	0.74	0.18	6.92	0.79	1.58	0.99	14.82	1.12	2.24	2.12	19.97	1.30	2.61	2.85
1.47	0.38	0.75	0.21	7.03	0.80	1.59	1.00	14.87	1.12	2.24	2.12	20.06	1.31	2.62	2.87
1.53	0.39	0.77	0.22	7.37	0.81	1.62	1.05	14.99	1.12	2.24	2.14	19.50	1.32	2.63	2.79
1.64	0.40	0.81	0.23	7.54	0.82	1.63	1.08	15.10	1.13	2.26	2.16	19.80	1.32	2.64	2.83
1.70	0.41	0.82	0.24	7.77	0.83	1.65	1.11	15.16	1.13	2.26	2.17	19.92	1.32	2.64	2.85
1.76	0.42	0.84	0.25	8.06	0.84	1.68	1.15	15.22	1.13	2.27	2.17	19.97	1.32	2.65	2.85
1.81	0.43	0.85	0.26	8.29	0.85	1.69	1.18	15.33	1.14	2.28	2.19	20.09	1.33	2.66	2.87
1.87	0.44	0.87	0.27	8.46	0.85	1.71	1.21	15.42	1.14	2.28	2.20	20.14	1.41	2.82	2.88
1.93	0.44	0.89	0.28	8.69	0.86	1.72	1.24	15.50	1.15	2.29	2.21				
1.98	0.45	0.90	0.28	8.80	0.87	1.74	1.26	15.68	1.15	2.30	2.24				
2.04	0.46	0.92	0.29	9.03	0.88	1.76	1.29	15.73	1.15	2.31	2.25				
2.10	0.47	0.93	0.30	9.14	0.88	1.77	1.31	15.85	1.16	2.31	2.26				
2.15	0.47	0.95	0.31	9.32	0.89	1.78	1.33	15.91	1.16	2.32	2.27				
2.33	0.50	0.99	0.33	9.43	0.90	1.79	1.35	16.08	1.17	2.33	2.30				
2.39	0.51	1.01	0.34	9.55	0.90	1.80	1.36	16.14	1.17	2.34	2.31				
				9.84	0.91	1.83	1.41	16.25	1.17	2.34	2.32				
				10.06	0.93	1.85	1.44	16.31	1.17	2.35	2.33				

Appendix 2r- 90day Direct Tensile Test Data for NT00-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)				
0.00	0.00	0.00	0.00	0.24	7.90	0.05	1.13
0.08	0.00	0.02	0.00	0.24	8.36	0.05	1.19
0.08	0.00	0.02	0.00	0.24	8.82	0.05	1.26
0.09	0.00	0.02	0.00	0.25	9.25	0.05	1.32
0.10	0.14	0.02	0.02	0.25	9.71	0.05	1.39
0.11	0.18	0.02	0.03	0.25	10.15	0.05	1.45
0.12	0.20	0.02	0.03	0.25	10.58	0.05	1.51
0.12	0.21	0.02	0.03	0.25	11.02	0.05	1.57
0.13	0.22	0.03	0.03	0.26	11.45	0.05	1.64
0.13	0.22	0.03	0.03	0.26	11.85	0.05	1.69
0.14	0.23	0.03	0.03	0.26	12.26	0.05	1.75
0.14	0.23	0.03	0.03	0.26	12.66	0.05	1.81
0.14	0.23	0.03	0.03	0.26	13.04	0.05	1.86
0.15	0.24	0.03	0.03	0.27	13.42	0.05	1.92
0.15	0.24	0.03	0.03	0.27	13.80	0.05	1.97
0.15	0.24	0.03	0.03	0.27	14.16	0.05	2.02
0.16	0.24	0.03	0.03	0.27	14.50	0.05	2.07
0.16	0.25	0.03	0.04	0.27	14.85	0.05	2.12
0.16	0.25	0.03	0.04	0.27	15.18	0.05	2.17
0.17	0.25	0.03	0.04	0.28	15.50	0.06	2.21
0.17	0.25	0.03	0.04	0.28	15.82	0.06	2.26
0.18	0.26	0.04	0.04	0.28	16.14	0.06	2.31
0.18	0.27	0.04	0.04	0.28	16.45	0.06	2.35
0.18	0.28	0.04	0.04	0.28	16.75	0.06	2.39

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)				
0.18	0.29	0.04	0.04	0.29	17.06	0.06	2.44
0.19	0.39	0.04	0.06	0.29	17.36	0.06	2.48
0.19	0.55	0.04	0.08	0.29	17.68	0.06	2.53
0.19	0.73	0.04	0.10	0.29	17.99	0.06	2.57
0.20	0.94	0.04	0.13	0.29	18.32	0.06	2.62
0.20	1.16	0.04	0.17	0.29	18.66	0.06	2.67
0.20	1.41	0.04	0.20	0.30	19.02	0.06	2.72
0.21	1.67	0.04	0.24	0.30	19.38	0.06	2.77
0.21	1.96	0.04	0.28	0.30	19.79	0.06	2.83
0.21	2.26	0.04	0.32	0.30	20.22	0.06	2.89
0.21	2.59	0.04	0.37	0.30	20.68	0.06	2.95
0.22	2.92	0.04	0.42	0.30	21.18	0.06	3.03
0.22	3.28	0.04	0.47	0.31	21.72	0.06	3.10
0.22	3.65	0.04	0.52				
0.22	4.04	0.04	0.58				
0.22	4.44	0.04	0.63				
0.23	4.85	0.05	0.69				
0.23	5.25	0.05	0.75				
0.23	5.69	0.05	0.81				
0.23	6.12	0.05	0.87				
0.23	6.56	0.05	0.94				
0.24	7.02	0.05	1.00				
0.24	7.46	0.05	1.07				

Appendix 2s- 90day Direct Tensile Test Data for NT0.5-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.00	0.000	0.00	0.00	5.55	0.003	0.01	0.79	11.71	0.003	0.01	1.67	16.63	0.003	0.01	2.38
0.05	0.000	0.00	0.01	5.68	0.003	0.01	0.81	11.79	0.003	0.01	1.68	16.69	0.003	0.01	2.38
0.05	0.001	0.00	0.01	5.78	0.003	0.01	0.83	11.93	0.003	0.01	1.70	16.77	0.003	0.01	2.40
0.05	0.001	0.00	0.01	5.93	0.003	0.01	0.85	12.07	0.003	0.01	1.72	16.84	0.003	0.01	2.41
0.06	0.003	0.01	0.01	5.96	0.003	0.01	0.85	12.31	0.003	0.01	1.76	17.02	0.003	0.01	2.43
0.10	0.003	0.01	0.01	6.18	0.003	0.01	0.88	12.49	0.003	0.01	1.78	17.12	0.003	0.01	2.45
0.13	0.003	0.01	0.02	6.23	0.003	0.01	0.89	12.49	0.003	0.01	1.78	17.16	0.003	0.01	2.45
0.17	0.003	0.01	0.02	6.39	0.003	0.01	0.91	12.61	0.003	0.01	1.80	17.25	0.004	0.01	2.46
0.25	0.003	0.01	0.04	6.52	0.003	0.01	0.93	12.64	0.003	0.01	1.81	17.32	0.003	0.01	2.47
0.63	0.003	0.01	0.09	6.64	0.003	0.01	0.95	12.78	0.003	0.01	1.83	17.40	0.003	0.01	2.49
0.75	0.003	0.01	0.11	6.69	0.003	0.01	0.96	12.85	0.003	0.01	1.84	17.46	0.004	0.01	2.49
0.79	0.003	0.01	0.11	6.89	0.003	0.01	0.98	13.01	0.003	0.01	1.86	17.52	0.003	0.01	2.50
1.02	0.003	0.01	0.15	6.92	0.003	0.01	0.99	13.19	0.003	0.01	1.88	20.17	0.004	0.01	2.88
1.08	0.003	0.01	0.15	7.12	0.003	0.01	1.02	13.32	0.003	0.01	1.90	17.88	0.004	0.01	2.55
1.13	0.003	0.01	0.16	7.26	0.003	0.01	1.04	12.50	0.003	0.01	1.79	17.91	0.004	0.01	2.56
1.19	0.003	0.01	0.17	7.32	0.003	0.01	1.05	13.59	0.003	0.01	1.94	18.01	0.004	0.01	2.57
1.23	0.002	0.00	0.18	7.44	0.003	0.01	1.06	13.72	0.003	0.01	1.96	18.28	0.004	0.01	2.61
1.31	0.003	0.01	0.19	7.57	0.003	0.01	1.08	13.85	0.003	0.01	1.98	18.37	0.004	0.01	2.62
1.43	0.003	0.01	0.20	7.67	0.003	0.01	1.10	13.94	0.003	0.01	1.99	18.41	0.004	0.01	2.63
1.60	0.002	0.00	0.23	7.73	0.003	0.01	1.10	14.07	0.003	0.01	2.01	18.60	0.004	0.01	2.66
1.72	0.003	0.01	0.25	7.84	0.003	0.01	1.12	14.31	0.003	0.01	2.04	18.67	0.004	0.01	2.67
1.81	0.002	0.00	0.26	7.94	0.003	0.01	1.13	14.47	0.003	0.01	2.07	18.74	0.004	0.01	2.68
1.96	0.002	0.00	0.28	8.04	0.003	0.01	1.15	14.49	0.003	0.01	2.07	18.83	0.004	0.01	2.69
2.08	0.003	0.01	0.30	8.13	0.003	0.01	1.16	14.57	0.003	0.01	2.08	18.95	0.004	0.01	2.71
2.43	0.003	0.01	0.35	8.31	0.003	0.01	1.19	14.65	0.003	0.01	2.09	19.06	0.006	0.01	2.72
2.57	0.003	0.01	0.37	8.52	0.003	0.01	1.22	14.44	0.003	0.01	2.06	19.17	0.006	0.01	2.74
2.62	0.003	0.01	0.37	8.55	0.003	0.01	1.22	14.53	0.003	0.01	2.08	19.28	0.006	0.01	2.75
2.81	0.003	0.01	0.40	8.68	0.003	0.01	1.24	14.55	0.003	0.01	2.08	19.40	0.006	0.01	2.77
3.03	0.003	0.01	0.43	8.79	0.003	0.01	1.26	14.63	0.003	0.01	2.09	19.51	0.006	0.01	2.79
2.96	0.003	0.01	0.42	8.91	0.003	0.01	1.27	14.67	0.003	0.01	2.10	19.62	0.006	0.01	2.80
3.32	0.003	0.01	0.47	8.93	0.003	0.01	1.28	14.76	0.003	0.01	2.11	19.74	0.006	0.01	2.82
3.42	0.003	0.01	0.49	9.10	0.003	0.01	1.30	14.81	0.003	0.01	2.12	19.85	0.006	0.01	2.84
3.64	0.003	0.01	0.52	9.20	0.003	0.01	1.31	14.90	0.003	0.01	2.13	19.96	0.006	0.01	2.85
3.71	0.003	0.01	0.53	9.33	0.003	0.01	1.33	15.10	0.003	0.01	2.16	20.07	0.006	0.01	2.87
3.90	0.003	0.01	0.56	9.45	0.003	0.01	1.35	15.29	0.003	0.01	2.18	20.19	0.006	0.01	2.88
4.07	0.003	0.01	0.58	9.56	0.003	0.01	1.37	15.41	0.003	0.01	2.20	20.30	0.006	0.01	2.90
4.25	0.003	0.01	0.61	9.73	0.003	0.01	1.39	15.62	0.003	0.01	2.23	17.52	0.006	0.01	2.50
4.39	0.003	0.01	0.63	9.91	0.003	0.01	1.42	15.78	0.003	0.01	2.25	20.52	0.007	0.01	2.93
4.71	0.003	0.01	0.67	10.08	0.003	0.01	1.44	15.84	0.003	0.01	2.26	20.64	0.007	0.01	2.95

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
4.80	0.003	0.01	0.69	10.31	0.003	0.01	1.47	15.97	0.003	0.01	2.28	20.75	0.007	0.01	2.96
4.91	0.003	0.01	0.70	10.36	0.003	0.01	1.48	16.21	0.003	0.01	2.32	20.86	0.007	0.01	2.98
5.98	0.003	0.01	0.85	10.53	0.003	0.01	1.50	16.28	0.003	0.01	2.33	20.97	0.007	0.01	3.00
5.05	0.003	0.01	0.72	10.77	0.003	0.01	1.54	16.32	0.003	0.01	2.33	21.09	0.007	0.01	3.01
5.12	0.003	0.01	0.73	10.94	0.003	0.01	1.56	16.40	0.003	0.01	2.34	21.20	0.007	0.01	3.03
5.19	0.003	0.01	0.74	11.01	0.003	0.01	1.57	16.38	0.003	0.01	2.34	21.31	0.007	0.01	3.04
5.36	0.003	0.01	0.77	11.18	0.003	0.01	1.60	16.39	0.003	0.01	2.34	21.42	0.007	0.01	3.06
5.50	0.003	0.01	0.79	11.31	0.003	0.01	1.62	16.41	0.003	0.01	2.34	21.54	0.007	0.01	3.08
				11.37	0.003	0.01	1.62	16.47	0.003	0.01	2.35	21.65	0.007	0.01	3.09
				11.48	0.003	0.01	1.64	16.58	0.003	0.01	2.37	21.77	0.007	0.01	3.11
21.88	0.007	0.01	3.13	30.71	1.88	3.76	4.39	36.86	2.380	4.76	5.27	43.29	4.410	8.82	6.18
21.99	0.007	0.01	3.14	30.88	1.92	3.84	4.41	36.91	2.390	4.78	5.27	43.56	4.460	8.92	6.22
22.10	0.007	0.01	3.16	30.91	2.01	4.02	4.42	36.98	2.430	4.86	5.28	43.66	4.478	8.96	6.24
22.22	0.007	0.01	3.17	30.98	2.11	4.22	4.43	37.19	2.450	4.90	5.31	43.78	4.489	8.98	6.25
17.58	0.007	0.01	2.51	31.04	2.16	4.32	4.43	37.28	2.460	4.92	5.33	43.89	4.520	9.04	6.27
22.44	0.006	0.01	3.21	31.10	2.18	4.36	4.44	37.33	2.490	4.98	5.33	43.97	4.550	9.10	6.28
22.55	0.006	0.01	3.22	31.22	2.190	4.38	4.46	37.48	2.520	5.04	5.35	44.28	4.580	9.16	6.33
22.67	0.006	0.01	3.24	31.27	2.198	4.40	4.47	37.55	2.531	5.06	5.36	44.34	4.610	9.22	6.33
22.78	0.006	0.01	3.25	31.31	2.200	4.40	4.47	37.67	2.539	5.08	5.38	44.41	4.640	9.28	6.34
22.89	0.006	0.01	3.27	31.44	2.210	4.42	4.49	37.78	2.622	5.24	5.40	44.54	4.650	9.30	6.36
23.24	0.007	0.01	3.32	31.51	2.230	4.46	4.50	37.81	2.640	5.28	5.40	44.67	4.680	9.36	6.38
23.78	0.008	0.02	3.40	31.67	2.240	4.48	4.52	37.96	2.690	5.38	5.42	30.33	4.730	9.46	4.33
23.42	0.008	0.02	3.35	31.77	2.270	4.54	4.54	38.22	2.720	5.44	5.46	30.11	4.790	9.58	4.30
23.96	0.008	0.02	3.42	31.89	2.280	4.56	4.56	38.34	2.790	5.58	5.48	30.01	4.830	9.66	4.29
25.06	0.008	0.02	3.58	31.95	2.290	4.58	4.56	38.41	2.820	5.64	5.49	29.89	4.880	9.76	4.27
25.87	0.009	0.02	3.70	32.18	2.310	4.62	4.60	38.65	2.850	5.70	5.52	29.79	4.890	9.78	4.26
25.63	0.009	0.02	3.66	32.29	2.320	4.64	4.61	38.75	2.910	5.82	5.54	29.68	4.910	9.82	4.24
26.03	0.009	0.02	3.72	32.34	2.334	4.67	4.62	38.89	2.980	5.96	5.56	29.57	4.930	9.86	4.22
26.44	0.010	0.02	3.78	32.41	2.350	4.70	4.63	38.92	3.010	6.02	5.56	29.44	4.970	9.94	4.21
26.67	0.015	0.03	3.81	33.54	2.357	4.71	4.79	39.18	3.110	6.22	5.60	29.33	4.980	9.96	4.19
26.89	0.020	0.04	3.84	33.67	2.360	4.72	4.81	39.38	3.190	6.38	5.63	29.21	5.000	10.00	4.17
26.97	0.030	0.06	3.85	33.78	2.410	4.82	4.83	39.47	3.220	6.44	5.64	29.11	5.010	10.02	4.16
27.13	0.034	0.07	3.88	33.87	2.480	4.96	4.84	39.51	3.290	6.58	5.64	29.01	5.040	10.08	4.14
27.45	0.035	0.07	3.92	33.91	2.510	5.02	4.84	39.67	3.340	6.68	5.67	28.81	5.050	10.10	4.12
27.67	0.040	0.08	3.95	33.98	2.540	5.08	4.85	39.78	3.380	6.76	5.68	28.71	5.055	10.11	4.10
27.87	0.053	0.11	3.98	34.01	2.560	5.12	4.86	39.81	3.410	6.82	5.69	28.68	5.060	10.12	4.10
27.91	0.059	0.12	3.99	34.10	2.570	5.14	4.87	39.88	3.460	6.92	5.70	28.56	5.070	10.14	4.08
28.19	0.072	0.14	4.03	34.28	2.580	5.16	4.90	39.94	3.490	6.98	5.71	28.44	5.080	10.16	4.06
28.26	0.089	0.18	4.04	34.33	2.640	5.28	4.90	40.15	3.520	7.04	5.74	28.41	5.110	10.22	4.06
28.35	0.091	0.18	4.05	34.55	2.710	5.42	4.94	40.37	3.550	7.10	5.77	28.10	5.180	10.36	4.01
28.44	0.130	0.26	4.06	34.67	2.750	5.50	4.95	40.58	3.580	7.16	5.80	27.56	5.200	10.40	3.94
28.61	0.180	0.36	4.09	34.71	2.780	5.56	4.96	40.67	3.620	7.24	5.81	27.44	5.210	10.42	3.92
28.71	0.290	0.58	4.10	34.75	2.810	5.62	4.96	40.78	3.680	7.36	5.83	27.01	5.220	10.44	3.86
28.88	0.350	0.70	4.13	34.81	2.870	5.74	4.97	40.89	3.690	7.38	5.84				
28.91	0.400	0.80	4.13	34.96	2.890	5.78	4.99	40.92	3.720	7.44	5.85				
29.10	0.560	1.12	4.16	35.10	2.910	5.82	5.01	41.22	3.770	7.54	5.89				
29.22	0.780	1.56	4.17	35.22	2.940	5.88	5.03	41.38	3.780	7.56	5.91				
29.35	0.810	1.62	4.19	35.25	2.950	5.90	5.04	41.44	3.810	7.62	5.92				
29.56	0.880	1.76	4.22	35.37	2.990	5.98	5.05	41.47	3.830	7.66	5.92				
29.67	0.920	1.84	4.24	35.45	3.010	6.02	5.06	41.56	3.880	7.76	5.94				
29.75	0.990	1.98	4.25	35.55	3.140	6.28	5.08	41.76	3.913	7.83	5.97				
29.88	1.100	2.20	4.27	35.67	3.170	6.34	5.10	41.88	3.980	7.96	5.98				
29.91	1.150	2.30	4.27	35.78	3.180	6.36	5.11	41.96	4.010	8.02	5.99				
30.17	1.320	2.64	4.31	36.03	3.220	6.44	5.15	42.14	4.019	8.04	6.02				
30.27	1.330	2.66	4.32	36.19	3.270	6.54	5.17	42.36	4.160	8.32	6.05				
30.33	1.35	2.70	4.33	36.33	3.290	6.58	5.19	42.55	4.180	8.36	6.08				
30.44	1.56	3.12	4.35	36.55	2.310	4.62	5.22	42.67	4.230	8.46	6.10				
30.54	1.68	3.36	4.36	36.61	2.330	4.66	5.23	42.78	4.330	8.66	6.11				
30.66	1.79	3.58	4.38	36.72	2.360	4.72	5.25	42.89	4.380	8.76	6.13				

Appendix 2t- 90day Direct Tensile Test Data for NT1.0-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.00	0.00	0.00	0.00	2.40	0.00	0.00	0.34	4.78	0.00	0.00	0.68	7.00	0.00	0.00	1.00
0.07	0.00	0.00	0.01	2.45	0.00	0.00	0.35	4.83	0.00	0.00	0.69	7.04	0.00	0.00	1.01
0.07	0.00	0.00	0.01	2.50	0.00	0.00	0.36	4.87	0.00	0.00	0.70	7.08	0.00	0.00	1.01

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
0.12	0.00	0.00	0.02	2.55	0.00	0.00	0.36	4.92	0.00	0.00	0.70	7.13	0.00	0.00	1.02
0.18	0.00	0.00	0.03	2.60	0.00	0.00	0.37	4.97	0.00	0.00	0.71	7.17	0.00	0.00	1.02
0.23	0.00	0.00	0.03	2.65	0.00	0.00	0.38	5.01	0.00	0.00	0.72	7.21	0.00	0.00	1.03
0.29	0.00	0.00	0.04	2.70	0.00	0.00	0.39	5.06	0.00	0.00	0.72	7.26	0.00	0.00	1.04
0.34	0.00	0.00	0.05	2.75	0.00	0.00	0.39	5.11	0.00	0.00	0.73	7.30	0.00	0.00	1.04
0.39	0.00	0.00	0.06	2.80	0.00	0.00	0.40	5.15	0.00	0.00	0.74	7.34	0.00	0.00	1.05
0.45	0.00	0.00	0.06	2.85	0.00	0.00	0.41	5.20	0.00	0.00	0.74	7.39	0.00	0.00	1.06
0.50	0.00	0.00	0.07	2.90	0.00	0.00	0.41	5.25	0.00	0.00	0.75	7.43	0.00	0.00	1.06
0.55	0.00	0.00	0.08	2.95	0.00	0.00	0.42	5.29	0.00	0.00	0.76	7.47	0.00	0.00	1.07
0.60	0.00	0.00	0.09	3.00	0.00	0.00	0.43	5.34	0.00	0.00	0.76	7.51	0.00	0.00	1.07
0.65	0.00	0.00	0.09	3.05	0.00	0.00	0.44	5.38	0.00	0.00	0.77	7.56	0.00	0.00	1.08
0.71	0.00	0.00	0.10	3.10	0.00	0.00	0.44	5.43	0.00	0.00	0.78	7.60	0.00	0.00	1.09
0.76	0.00	0.00	0.11	3.15	0.00	0.00	0.45	5.48	0.00	0.00	0.78	7.64	0.00	0.00	1.09
0.81	0.00	0.00	0.12	3.20	0.00	0.00	0.46	5.52	0.00	0.00	0.79	7.69	0.00	0.00	1.10
0.87	0.00	0.00	0.12	3.24	0.00	0.00	0.46	5.57	0.00	0.00	0.80	7.73	0.00	0.00	1.10
0.92	0.00	0.00	0.13	3.29	0.00	0.00	0.47	5.61	0.00	0.00	0.80	7.77	0.00	0.00	1.11
0.97	0.00	0.00	0.14	3.34	0.00	0.00	0.48	5.66	0.00	0.00	0.81	7.81	0.00	0.00	1.12
1.02	0.00	0.00	0.15	3.39	0.00	0.00	0.48	5.70	0.00	0.00	0.81	7.85	0.00	0.00	1.12
1.07	0.00	0.00	0.15	3.44	0.00	0.00	0.49	5.75	0.00	0.00	0.82	7.90	0.00	0.00	1.13
1.13	0.00	0.00	0.16	3.49	0.00	0.00	0.50	5.79	0.00	0.00	0.83	7.94	0.00	0.00	1.13
1.18	0.00	0.00	0.17	3.54	0.00	0.00	0.51	5.84	0.00	0.00	0.83	7.98	0.00	0.00	1.14
1.23	0.00	0.00	0.18	3.59	0.00	0.00	0.51	5.89	0.00	0.00	0.84	8.02	0.00	0.00	1.15
1.28	0.00	0.00	0.18	3.63	0.00	0.00	0.52	5.93	0.00	0.00	0.85	8.06	0.00	0.00	1.15
1.33	0.00	0.00	0.19	3.68	0.00	0.00	0.53	5.98	0.00	0.00	0.85	8.11	0.00	0.00	1.16
1.38	0.00	0.00	0.20	3.73	0.00	0.00	0.53	6.02	0.00	0.00	0.86	8.15	0.00	0.00	1.16
1.44	0.00	0.00	0.21	3.78	0.00	0.00	0.54	6.07	0.00	0.00	0.87	8.19	0.00	0.00	1.17
1.49	0.00	0.00	0.21	3.83	0.00	0.00	0.55	6.11	0.00	0.00	0.87	8.23	0.00	0.00	1.18
1.54	0.00	0.00	0.22	3.88	0.00	0.00	0.55	6.16	0.00	0.00	0.88	8.27	0.00	0.00	1.18
1.59	0.00	0.00	0.23	3.93	0.00	0.00	0.56	6.20	0.00	0.00	0.89	8.32	0.00	0.00	1.19
1.64	0.00	0.00	0.23	3.97	0.00	0.00	0.57	6.25	0.00	0.00	0.89	8.36	0.00	0.00	1.19
1.69	0.00	0.00	0.24	4.02	0.00	0.00	0.57	6.29	0.00	0.00	0.90	8.40	0.00	0.00	1.20
1.74	0.00	0.00	0.25	4.07	0.00	0.00	0.58	6.34	0.00	0.00	0.91	8.44	0.00	0.00	1.21
1.79	0.00	0.00	0.26	4.12	0.00	0.00	0.59	6.38	0.00	0.00	0.91	8.48	0.00	0.00	1.21
1.84	0.00	0.00	0.26	4.17	0.00	0.00	0.60	6.42	0.00	0.00	0.92	7.44	0.00	0.01	1.06
1.90	0.00	0.00	0.27	4.21	0.00	0.00	0.60	6.47	0.00	0.00	0.92	8.56	0.00	0.01	1.22
1.95	0.00	0.00	0.28	4.26	0.00	0.00	0.61	6.51	0.00	0.00	0.93	8.60	0.00	0.01	1.23
2.00	0.00	0.00	0.29	4.31	0.00	0.00	0.62	6.56	0.00	0.00	0.94	8.65	0.00	0.01	1.24
2.05	0.00	0.00	0.29	4.35	0.00	0.00	0.62	6.60	0.00	0.00	0.94	8.69	0.00	0.01	1.24
2.10	0.00	0.00	0.30	4.40	0.00	0.00	0.63	6.65	0.00	0.00	0.95	8.73	0.00	0.01	1.25
2.15	0.00	0.00	0.31	4.45	0.00	0.00	0.64	6.69	0.00	0.00	0.96	8.77	0.00	0.01	1.25
2.20	0.00	0.00	0.31	4.50	0.00	0.00	0.64	6.73	0.00	0.00	0.96	8.81	0.00	0.01	1.26
2.25	0.00	0.00	0.32	4.54	0.00	0.00	0.65	6.78	0.00	0.00	0.97	8.85	0.00	0.01	1.26
2.30	0.00	0.00	0.33	4.59	0.00	0.00	0.66	6.82	0.00	0.00	0.97	8.89	0.00	0.01	1.27
2.35	0.00	0.00	0.34	4.64	0.00	0.00	0.66	6.87	0.00	0.00	0.98	8.93	0.00	0.01	1.28
				4.69	0.00	0.00	0.67	6.91	0.00	0.00	0.99	8.97	0.00	0.01	1.28
				4.73	0.00	0.00	0.68	6.95	0.00	0.00	0.99	9.01	0.00	0.01	1.29
9.05	0.00	0.01	1.29	12.15	0.26	0.51	1.74	14.58	0.65	1.31	2.08	17.12	2.58	5.15	2.45
9.09	0.00	0.01	1.30	12.21	0.26	0.53	1.74	14.60	0.67	1.35	2.09	17.23	2.59	5.18	2.46
9.13	0.00	0.01	1.30	12.23	0.27	0.54	1.75	14.63	0.68	1.37	2.09	17.27	2.76	5.52	2.47
9.17	0.00	0.01	1.31	12.25	0.27	0.54	1.75	14.71	0.69	1.38	2.10	17.32	2.78	5.56	2.47
9.22	0.00	0.01	1.32	12.28	0.29	0.58	1.75	14.75	0.71	1.42	2.11	17.36	2.81	5.63	2.48
9.25	0.00	0.01	1.32	12.30	0.29	0.58	1.76	14.77	0.73	1.47	2.11	17.39	2.88	5.75	2.48
9.29	0.00	0.01	1.33	12.35	0.31	0.63	1.76	14.82	0.74	1.49	2.12	17.51	2.94	5.88	2.50
9.33	0.00	0.01	1.33	12.37	0.32	0.65	1.77	14.85	0.75	1.50	2.12	17.54	2.96	5.91	2.51
9.37	0.00	0.01	1.34	12.38	0.33	0.66	1.77	14.90	0.76	1.52	2.13	17.57	3.01	6.02	2.51
9.41	0.00	0.01	1.34	12.44	0.34	0.67	1.78	14.94	0.76	1.53	2.13	17.62	3.07	6.13	2.52
9.58	0.00	0.01	1.37	12.46	0.34	0.68	1.78	14.96	0.78	1.56	2.14	17.67	3.09	6.18	2.52
9.64	0.00	0.01	1.38	12.53	0.34	0.69	1.79	15.01	0.78	1.56	2.14	12.00	3.12	6.25	1.71
9.72	0.00	0.01	1.39	12.57	0.35	0.70	1.80	15.12	0.79	1.58	2.16	11.91	3.23	6.46	1.70
9.85	0.00	0.01	1.41	12.61	0.36	0.71	1.80	15.16	0.81	1.62	2.17	11.87	3.25	6.49	1.70
9.91	0.00	0.01	1.42	12.64	0.36	0.71	1.81	15.19	0.82	1.65	2.17	11.82	3.26	6.51	1.69
10.23	0.00	0.01	1.46	12.73	0.36	0.72	1.82	15.29	0.83	1.66	2.18	11.78	3.26	6.53	1.68
10.14	0.00	0.01	1.45	12.77	0.36	0.72	1.82	15.33	0.83	1.67	2.19	11.74	3.27	6.53	1.68
10.30	0.00	0.01	1.47	12.79	0.37	0.73	1.83	15.38	0.84	1.68	2.20	11.70	3.29	6.58	1.67
10.46	0.00	0.01	1.49	12.82	0.37	0.74	1.83	15.39	0.85	1.69	2.20	11.64	3.29	6.58	1.66
10.55	0.00	0.01	1.51	13.27	0.37	0.74	1.90	15.50	0.85	1.70	2.21	11.60	3.30	6.61	1.66
10.64	0.00	0.01	1.52	13.32	0.38	0.76	1.90	15.58	0.86	1.72	2.23	11.55	3.31	6.63	1.65
10.67	**0.01**	0.02	1.52	13.36	0.39	0.77	1.91	15.61	0.86	1.72	2.23	11.51	3.33	6.66	1.64
10.73	0.01	0.02	1.53	13.40	0.39	0.78	1.91	15.63	0.87	1.73	2.23	11.47	3.34	6.68	1.64

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)												
10.86	0.01	0.02	1.55	13.41	0.40	0.80	1.92	15.69	0.87	1.74	2.24	11.40	3.56	7.12	1.63
10.94	0.01	0.02	1.56	13.44	0.41	0.82	1.92	15.73	0.88	1.76	2.25	11.36	3.59	7.18	1.62
11.02	0.01	0.02	1.57	13.45	0.41	0.83	1.92	15.75	0.89	1.79	2.25	11.34	3.62	7.24	1.62
11.04	0.01	0.02	1.58	13.49	0.42	0.84	1.93	15.77	0.91	1.82	2.25	11.30	3.63	7.25	1.61
11.15	**0.02**	0.04	1.59	13.56	0.43	0.87	1.94	15.80	0.92	1.84	2.26	11.25	3.64	7.28	1.61
11.18	**0.02**	0.04	1.60	13.58	0.44	0.89	1.94	15.88	0.92	1.84	2.27	11.24	3.69	7.38	1.61
11.21	**0.02**	0.04	1.60	13.67	0.46	0.91	1.95	15.97	0.93	1.86	2.28	11.11	3.72	7.43	1.59
11.25	**0.03**	0.06	1.61	13.71	0.46	0.92	1.96	16.05	1.22	2.44	2.29	10.90	3.73	7.46	1.56
11.32	**0.03**	0.06	1.62	13.73	0.47	0.95	1.96	16.09	1.26	2.51	2.30	10.85	3.74	7.47	1.55
11.36	**0.03**	0.06	1.62	13.74	0.48	0.96	1.96	16.13	1.35	2.69	2.30	10.68	3.75	7.49	1.53
11.42	0.04	0.08	1.63	13.77	0.48	0.96	1.97	16.17	1.39	2.78	2.31				
11.43	0.04	0.09	1.63	13.83	0.49	0.98	1.98	16.19	1.44	2.88	2.31				
11.51	0.05	0.10	1.64	13.88	0.50	1.00	1.98	16.30	1.56	3.11	2.33				
11.56	0.05	0.10	1.65	13.93	0.52	1.05	1.99	16.37	1.77	3.54	2.34				
11.61	0.07	0.14	1.66	13.94	0.55	1.11	1.99	16.39	1.88	3.77	2.34				
11.69	0.09	0.18	1.67	13.99	0.57	1.13	2.00	16.40	1.98	3.97	2.34				
11.74	0.10	0.20	1.68	14.02	0.57	1.15	2.00	16.44	2.00	4.00	2.35				
11.77	0.16	0.32	1.68	14.06	0.58	1.16	2.01	16.52	2.12	4.25	2.36				
11.82	0.18	0.35	1.69	14.11	0.59	1.19	2.02	16.56	2.20	4.40	2.37				
11.83	0.18	0.36	1.69	14.15	0.60	1.21	2.02	16.60	2.21	4.43	2.37				
11.93	0.18	0.36	1.70	14.25	0.62	1.23	2.04	16.67	2.26	4.51	2.38				
11.97	0.19	0.39	1.71	14.31	0.62	1.24	2.04	16.75	2.29	4.58	2.39				
12.00	0.21	0.42	1.71	14.37	0.63	1.27	2.05	16.83	2.34	4.68	2.40				
12.04	0.21	0.43	1.72	14.46	0.64	1.28	2.07	16.88	2.42	4.83	2.41				
12.08	0.22	0.45	1.73	14.48	0.64	1.28	2.07	16.92	2.50	5.00	2.42				
12.13	0.25	0.50	1.73	14.52	0.65	1.30	2.07	16.96	2.52	5.03	2.42				

Appendix 2u- 90day Direct Tensile Test Data for NTpowder-Composite Composite (Average)

Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)																
0.05	0.05	0.10	0.01	0.51	2.64	1.01	0.38	0.80	10.00	1.61	1.43	1.06	15.72	2.12	2.25	1.32	18.97	2.64	2.71
0.05	0.17	0.10	0.02	0.51	2.74	1.01	0.39	0.80	10.16	1.61	1.45	1.08	15.77	2.16	2.25	1.32	19.16	2.64	2.74
0.05	0.16	0.10	0.02	0.51	2.85	1.01	0.41	0.82	10.33	1.65	1.48	1.08	15.82	2.16	2.26	1.32	19.36	2.64	2.77
0.07	0.21	0.14	0.03	0.51	2.96	1.01	0.42	0.82	10.50	1.65	1.50	1.10	15.87	2.20	2.27	1.32	19.59	2.64	2.80
0.07	0.25	0.14	0.04	0.53	3.07	1.05	0.44	0.82	10.66	1.65	1.52	1.10	15.92	2.20	2.27	1.34	19.82	2.68	2.83
0.11	0.30	0.22	0.04	0.53	3.19	1.05	0.46	0.84	10.81	1.69	1.54	1.10	15.96	2.20	2.28	1.36	20.06	2.72	2.87
0.11	0.34	0.22	0.05	0.53	3.30	1.05	0.47	0.84	10.98	1.69	1.57	1.10	16.00	2.20	2.29	1.36	20.32	2.72	2.90
0.13	0.38	0.26	0.05	0.55	3.42	1.09	0.49	0.84	11.14	1.69	1.59	1.10	16.04	2.20	2.29	1.36	20.60	2.72	2.94
0.15	0.41	0.30	0.06	0.55	3.55	1.09	0.51	0.84	11.30	1.69	1.61	1.10	16.08	2.20	2.30	1.36	20.89	2.72	2.98
0.15	0.45	0.30	0.06	0.55	3.67	1.09	0.52	0.86	11.45	1.73	1.64	1.12	16.12	2.24	2.30	1.36	21.19	2.72	3.03
0.17	0.49	0.34	0.07	0.57	3.80	1.13	0.54	0.86	11.61	1.73	1.66	1.12	16.16	2.24	2.31	1.36	21.52	2.72	3.07
0.19	0.52	0.38	0.07	0.57	3.93	1.13	0.56	0.86	11.76	1.73	1.68	1.14	16.19	2.28	2.31	1.36	21.85	2.72	3.12
0.21	0.56	0.42	0.08	0.57	4.06	1.13	0.58	0.86	11.91	1.73	1.70	1.14	16.23	2.28	2.32	1.38	22.21	2.76	3.17
0.21	0.59	0.42	0.08	0.59	4.20	1.17	0.60	0.88	12.06	1.77	1.72	1.14	16.26	2.28	2.32	1.40	22.59	2.80	3.23
0.21	0.62	0.42	0.09	0.59	4.33	1.17	0.62	0.88	12.20	1.77	1.74	1.14	16.29	2.28	2.33	1.40	22.98	2.80	3.28
0.21	0.66	0.42	0.09	0.61	4.47	1.21	0.64	0.88	12.35	1.77	1.76	1.14	16.33	2.28	2.33	1.40	23.40	2.80	3.34
0.25	0.69	0.50	0.10	0.61	4.61	1.21	0.66	0.90	12.49	1.80	1.78	1.16	16.36	2.32	2.34	1.40	23.83	2.80	3.40
0.25	0.73	0.50	0.10	0.61	4.76	1.21	0.68	0.90	12.63	1.80	1.80	1.16	16.39	2.32	2.34	1.40	24.29	2.80	3.47
0.25	0.77	0.50	0.11	0.61	4.90	1.21	0.70	0.90	12.77	1.80	1.82	1.16	16.42	2.32	2.35	1.40	24.77	2.80	3.54
0.27	0.80	0.54	0.11	0.63	5.05	1.25	0.72	0.90	12.91	1.80	1.84	1.18	16.45	2.36	2.35	1.40	25.26	2.80	3.61
0.29	0.84	0.58	0.12	0.63	5.20	1.25	0.74	0.92	13.03	1.84	1.86	1.18	16.49	2.36	2.36	1.40	25.79	2.80	3.68
0.29	0.88	0.58	0.13	0.64	5.36	1.29	0.77	0.92	13.17	1.84	1.88	1.18	16.52	2.36	2.36	1.44	26.34	2.87	3.76
0.29	0.92	0.58	0.13	0.64	5.50	1.29	0.79	0.94	13.29	1.88	1.90	1.18	16.56	2.36	2.37	1.44	26.92	2.87	3.85
0.31	0.96	0.62	0.14	0.64	5.66	1.29	0.81	0.94	13.42	1.88	1.92	1.20	16.59	2.40	2.37	1.44	27.51	2.87	3.93
0.31	1.00	0.62	0.14	0.64	5.82	1.29	0.83	0.94	13.54	1.88	1.93	1.20	16.63	2.40	2.38	1.44	28.13	2.87	4.02
0.33	1.05	0.66	0.15	0.64	5.98	1.29	0.85	0.94	13.66	1.88	1.95	1.20	16.67	2.40	2.38	1.44	28.80	2.87	4.11
0.33	1.10	0.66	0.16	0.66	6.14	1.33	0.88	0.94	13.78	1.88	1.97	1.20	16.71	2.40	2.39	1.44	29.48	2.87	4.21
0.35	1.15	0.70	0.16	0.68	6.30	1.37	0.90	0.94	13.90	1.88	1.99	1.20	16.75	2.40	2.39	1.44	30.19	2.87	4.31
0.35	1.20	0.70	0.17	0.68	6.46	1.37	0.92	0.96	14.01	1.92	2.00	1.22	16.80	2.44	2.40	1.46	30.92	2.91	4.42
0.35	1.25	0.70	0.18	0.68	6.63	1.37	0.95	0.98	14.12	1.96	2.02	1.22	16.85	2.44	2.41	1.46	31.69	2.91	4.53
0.37	1.30	0.73	0.19	0.68	6.79	1.37	0.97	0.98	14.23	1.96	2.03	1.22	16.90	2.44	2.41	1.48	32.51	2.95	4.64
0.37	1.36	0.73	0.19	0.68	6.96	1.37	0.99	0.98	14.33	1.96	2.05	1.24	16.95	2.48	2.42	1.48	33.34	2.95	4.76
0.39	1.42	0.77	0.20	0.68	7.12	1.37	1.02	0.98	14.43	1.96	2.06	1.24	17.01	2.48	2.43	1.48	34.22	2.95	4.89
0.39	1.48	0.77	0.21	0.72	7.29	1.45	1.04	0.98	14.53	1.96	2.08	1.24	17.08	2.48	2.44	1.48	35.11	2.95	5.02
0.39	1.55	0.77	0.22	0.72	7.46	1.45	1.07	0.98	14.62	1.96	2.09	1.24	17.15	2.48	2.45	1.48	36.06	2.95	5.15
0.39	1.62	0.77	0.23	0.72	7.63	1.45	1.09	0.98	14.72	1.96	2.10	1.24	17.22	2.48	2.46	1.48	37.04	2.95	5.29

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Extension (mm)	Load (kN)	Strain (%)	Stress (MPa)																
0.43	1.69	0.85	0.24	0.72	7.80	1.45	1.11	1.02	14.80	2.04	2.11	1.26	17.30	2.52	2.47	1.50	38.05	2.99	5.44
0.43	1.76	0.85	0.25	0.72	7.97	1.45	1.14	1.02	14.89	2.04	2.13	1.26	17.38	2.52	2.48				
0.43	1.83	0.85	0.26	0.72	8.14	1.45	1.16	1.02	14.97	2.04	2.14	1.26	17.47	2.52	2.50				
0.43	1.91	0.85	0.27	0.74	8.31	1.49	1.19	1.02	15.06	2.04	2.15	1.28	17.56	2.56	2.51				
0.43	1.99	0.85	0.28	0.76	8.48	1.53	1.21	1.02	15.13	2.04	2.16	1.28	17.67	2.56	2.52				
0.47	2.08	0.93	0.30	0.76	8.65	1.53	1.24	1.02	15.21	2.04	2.17	1.28	17.78	2.56	2.54				
0.47	2.16	0.93	0.31	0.76	8.82	1.53	1.26	1.02	15.28	2.04	2.18	1.28	17.89	2.56	2.56				
0.47	2.25	0.93	0.32	0.76	8.99	1.53	1.28	1.04	15.35	2.08	2.19	1.28	18.02	2.56	2.57				
0.47	2.34	0.93	0.33	0.76	9.16	1.53	1.31	1.06	15.42	2.12	2.20	1.30	18.15	2.60	2.59				
0.47	2.44	0.93	0.35	0.78	9.33	1.57	1.33	1.06	15.49	2.12	2.21	1.30	18.30	2.60	2.61				
0.49	2.54	0.97	0.36	0.78	9.49	1.57	1.36	1.06	15.55	2.12	2.22	1.32	18.45	2.64	2.64				
				0.80	9.67	1.61	1.38	1.06	15.66	2.12	2.24	1.32	18.78	2.64	2.68				
				0.80	9.83	1.61	1.40												

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