

# **Glass Poly-Vinyl-Phosphonate Cements with Reactive Aluminium Hydroxide Coated Sub-micron Anatase Filler**

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**June 30th, 2011**

**Submitted by Paul Brookbank, to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Engineering, June 2011.**

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**(Paul Alexander Brookbank)**

## **Abstract**

The current generation of Glass Ionomer Cements (GICs) have many advantageous properties over other dental restorative materials but lack the compressive strength of these other materials. The aim of this project is to increase the compressive strength of conventional Glass Poly-Vinyl-Phosphonate cement by inclusion of reactive sub-micron filler particles.

The setting characteristics, chemical reactivity and cement strength have been found using oscillating rheology, infrared spectrometry, nuclear magnetic spectrometry, transmission electron microscopy, potentiometer analysis, laser diffractometry and mechanical analysis.

The addition of sub-micron filler particles in direct weight by weight replacement of aluminosilicate glass of a control material has increased the ultimate compressive strength of the new cement from 206MPa (control) to 250MPa after 365 days of aging. The strength of the new filler enhanced cements were comparable with the control material after 3 hours. The setting chemistry of the filler enhanced cements follows the same order as the control cement but at a decelerated rate.

Theoretical modelling found that a large volume of sub-micron filler could fit into interstitial spacing in formed cement however the alteration of the aluminosilicate glass to polyelectrolyte ratio has been found to drastically alter the cement setting time.

The use of cubic and polyhedral shaped filler particles as supposed to spherical particles may increase the cement strength further as greater packing densities are achieved.

The formulation of a Glass Ionomer Cement with increased compressive strength may find use as a posterior restorative or as a better material for restoration of lesions and cavity liners.

## **Acknowledgments**

I would like to express my gratitude to my supervisors Dr Oana Ghita, Dr Michele Barbour and Professor Ken Evans for firstly giving me the opportunity to undertake this research and their continued support and guidance during this research project.

This research has been funded by the Great Western Research fund and Associated Dental Products (Kemdent, Swindon). I would like to thank Tony Cook of Kemdent for his knowledge of quality control for water based dental cements and providing me with materials to perform my research.

A special thank you is extended to Mr Ian Moon and Mr Peter Jerry for their skill, hard work and technical guidance provided when producing parts and supervising myself in the workshop environment; their tuition has evolved into a firm friendship.

My love goes to my partner Ailichia and daughter Lilly for all their unwavering encouragement, motivation and patients without which, none of this would have been possible.

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