Experimental and Numerical Analysis of Thermoplastic Laminates Reinforced with Jute Fabric

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ABSTRACT

Conventional fibre-reinforced composites, usually reinforced with carbon and glass fibres, are extensively used for advanced applications but do not meet the current environmental concern strongly related to the life cycle assessment of material and structural components. Thus, over the last decades, a growing interest has been directed, on one hand, towards the development of new materials with competitive performance while ensuring environmental sustainability and, on the other hand, towards the implementation of effective end-of-life strategies such as to ensure the compliance with circularity criteria.

In this context, outstanding attention is devoted to thermoplastic matrix composite materials, intrinsically recyclable compared to thermosetting ones, containing natural reinforcing phases such as vegetable fibres.

In this work, jute fabric-reinforced laminates based on bio-based thermoplastic matrices were fabricated using hand lay-up and hot compaction procedures and systematically explored by mechanical tests and numerical tools. The multiscale modelling of the present composite was considered via molecular dynamics simulation as well as continuum mechanics models.

In detail, to verify the damage tolerance of the explored systems and asses their usability, flexural and impact measurements were performed on specimens cut from the laminated products. The experimental results were supported by a morphological analysis of the fractured surfaces, performed to get insights into the involved damage mechanisms and compared with data predicted by suitable theoretical simulation tools.