



MATERIAIS 2025

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► XXII Congresso da Sociedade Portuguesa de Materiais
► XIII International Symposium on Materials
► III Iberian Meeting on Materials Science

JULY 1-3 2025

Instituto Superior Técnico,
Lisboa, Portugal

Effect of Salinity on the Degradation of PMMA Matrix Composites Reinforced with Carbon Fibers for Nautical Applications

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Polymer matrix composites are widely used in the marine industry due to their excellent properties. However, with increasing environmental concerns, there has been a need to develop new alternative matrices to thermosets ones, which have the potential for reuse without compromising the performance of the application.

In this context, Elium 180 XO, a thermoplastic resin with a PMMA matrix, developed by Arkema, has emerged. Its main advantage is its recyclability, presenting physical-mechanical and usage properties like those of thermosetting resins. In addition to maintaining its good properties, this resin can be recycled, reducing waste since most end-of-life boats are abandoned in sheds or sunk. Despite these advantages, when exposed to saline environments for long periods, this resin presents degradation due to the absorption of salts, which accelerates the deterioration process of the matrix and the structural integrity of the composite.

This work investigates the influence of salinity on the degradation of structural composite laminates based on PMMA matrix reinforced with carbon fibers, processed by the liquid resin infusion technique, for nautical applications. After the infusion, the laminate will have a curing time of 24 hours at room temperature. After that, it will be cut into two equal parts. As the manufacturer recommends, one of the parts will be post-cured in an oven at 80°C for 2 hours. The other one will not undergo any post-curing process. Then, both plates will be cut into test specimens that will be used to perform Short Beam Strength (SBS) tests and calculate the percentage of water absorption. In parallel to this process, non-reinforced polymer resin immersed in the solution will be analyzed by Differential Scanning Calorimetry (DSC), Thermogravimetric Analysis (TGA), and Fourier Transform Infrared (FTIR) to observe any variation in properties. Over 6 months, the materials subjected to water at room temperature will be tested, with periodic monthly characterizations, to monitor the degradation of properties that may indicate degradation when compared to the samples' reference values (without immersion).