

Study of optimized carbon fiber/PEEK adhesion by scanning electron microscope

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Abstract – Two composites based on PEEK/carbon fiber were evaluated by Scanning Electron Microscope in order to evaluate the surface morphology, one with polyimide (PI) as interphase and other without PI. It was observed that the composite with PI interphase showed better matrix wettability on carbon fiber surface.

The composites mechanical properties are strong linked to interfacial matrix/reinforcement adhesion. The better the adhesion, the better the stress transfer between matrix and the reinforcement. The carbon fiber surface has large chemical inertia, diffculting a good adhesion. In order to solve this problem, some procedures are adopted: surface treatment with acid solution or plasma and posterior coating (sizing) on the reinforcement surface [1-3].

Carbon fiber fabric (plain weave) was washed with ketone to eliminate their original sizing, and posteriorly imersed in a solution of PAA (polyamic acid), consisting of BTDA/ODA-PI (polyimide pre-polymer). The fabrics were thermal treated (1h at 100°C; 1h at 200°C) in a vacuum oven, in order to eliminate the humidity and solvent. Next, the fabrics with the new sizing of PAA were covered with powder of the polymeric matrix, PEEK (poly(ether ether ketone), with 50:50 (w/w). One carbon fiber/PEEK composite with the original sizing were also prepared. The composites were processed with hot press method, at 400°C and 5 MPa. The obtained composites were manually broken in order to analyze the fracture by Scanning Electron Microscope (SEM).

SEM analysis showed that carbon fibers were coated completely with matrix and the failure did not occur at the interface of the fiber/matrix (Fig. 1 and 2). The failure occurs in the bulk matrix, in both cases. Therefore, the polyimide interphase/PEEK matrix composite shows better wettability and union with the carbon carbon filaments, suggesting that the polyimide interphase has influence on the PEEK/carbon fiber adhesion. In previous work, Olivo et al [5] showed by thermal analysis and polarized light microscopy that the system BTDA/ODA-PI and PEEK originate a blend. This explain the behaviour of fibre/matrix adhesion with the PI.

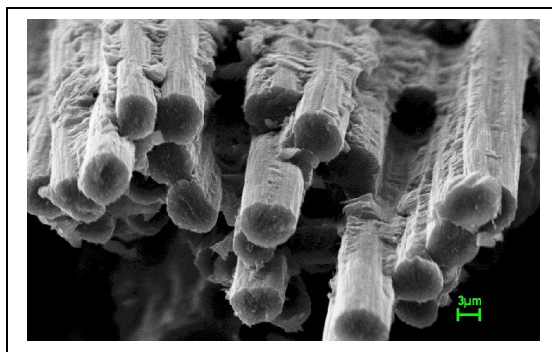
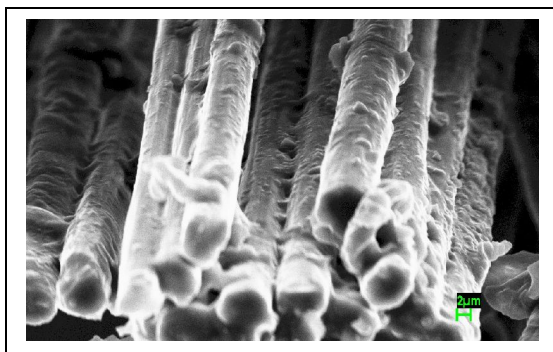


Figure 1: SEM image of PEEK/carbon fiber composite. Figure 2: SEM image of PEEK/PI sizing/carbon fiber composite.

References

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