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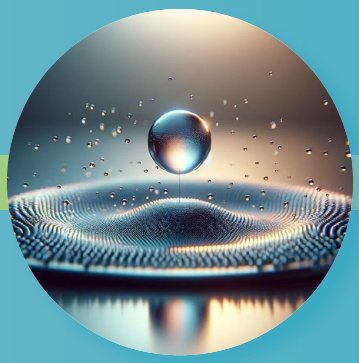
Amorphous Content



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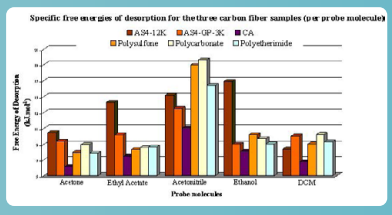
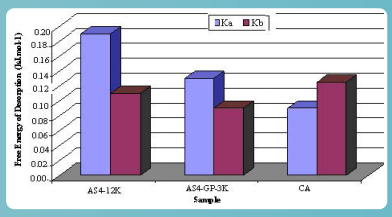
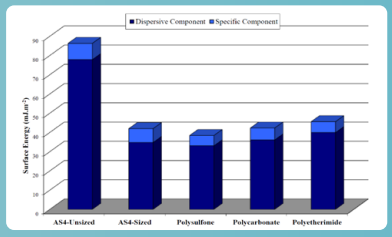


Dispersive surface energies of different fibres and polymers measured at 303 K



Acid (Ka) and base (Kb) numbers for different carbon fibres calculated from specific free energies



Dispersive, specific and total surface energies for carbon fibres and polymers

Case Study 604

The Problem: Carbon fibre-reinforced composites rely heavily on interfacial adhesion between fibre and polymer for mechanical strength. This study investigates how oxidation and epoxy-based sizing of PAN-based carbon fibres influence surface energetics and interactions with thermoplastic polymers. Understanding these changes is crucial for optimizing composite performance and ensuring compatibility between components.

The Techniques: Inverse Gas Chromatography (iGC)

The Research: Surface energies and acid-base properties of three carbon fibres and three polymers were characterized via IGC SEA. Mechanical adhesion was assessed by fibre pull-out testing to correlate with calculated work of adhesion.

The Results: Oxidation increased fibre surface energy and acidity, improving predicted adhesion and interfacial shear strength. Sizing further increased specific surface energy but did not enhance mechanical adhesion, likely due to incompatibility with the polymer. Correlations between IGC-derived adhesion values and mechanical performance support IGC SEA as a predictive tool for composite optimization.

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