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THE INVESTIGATION OF FIBRE REINFORCEMENT EFFECTS IN THERMOPLASTIC MATERIALS: INTERFACIAL BOND STRENGTH AND FIBRE END PARAMETER

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Glass fibres used in the manufacture of fibre reinforced thermoplastic composites (FRTP) are normally sized with a film former which includes a silane coupling agent to improve the interfacial bond strength between glass fibre and matrix. However, during composite failure even an optimized interface cannot stop the initiation of cracks at the fibre ends, which can lead to large transverse cracks in the matrix or failure by fibre pull-out. In order to help better understand the failure mechanisms of FRTP, thermoplastic microbond tests and photoelasticity experiments have been used to study the interface in model single fibre composites. The interfacial shear stress (IFSS) values obtained from the microbond test method show that γ -amino-propyltriethoxy silane improves the wettability and adhesion of E-glass fibres to the nylon-6 polymer, and that water extraction of the silane sized fibres increases the observed IFSS (Figure 1).

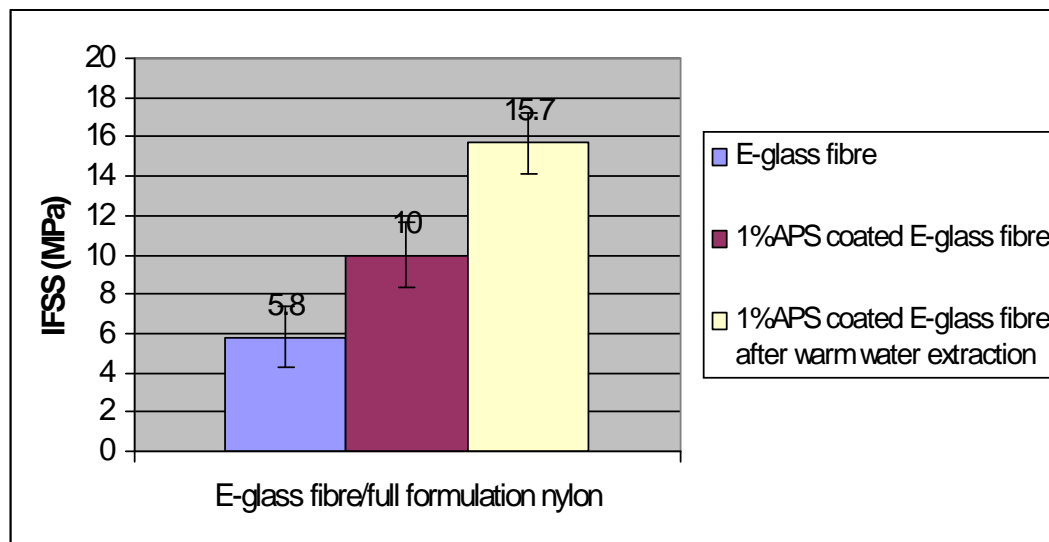


Fig. 1: IFSS values of differently silanized E-glass fibre in a full formulated nylon matrix

Figure 2 shows a contour map of isochromatic fringe order around the end of an embedded glass fibre in amorphous polyamide obtained from the photoelasticity experiment. This has

been used to describe the details of stress field in polyamide matrix when the single fibre composite specimen was subject to the uniaxial tension. It can be seen from the figure 2 that a small region of high fringe order around the square shape fibre end when the applied matrix stress on the specimen at 29 MPa, which can be considered as the high stress concentration in the polyamide matrix.

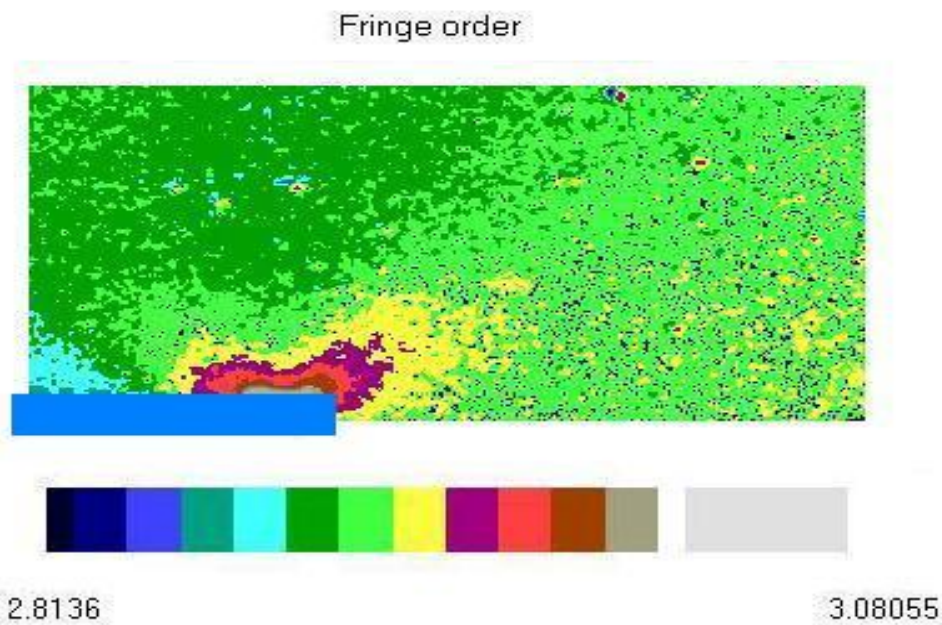


Fig. 2: Contour map of isochromatic fringe orders in the polyamide matrix around the square shape fibre ends 29.1MPa