DEVELOPMENT AND ANALYSIS OF LONG FIBER REINFORCED POLYPROPYLENE COMPOSITES

by

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1. Polypropylene

CERTIFICATE

This is to certify that the thesis entitled **"Development and Analysis of Lon Fiber Reinforced Polypropylene Composites"** submitted by **Mr. K. Senthil Kumar** t the Indian Institute of Technology, Delhi, for the award of degree of **Doctor c Philosophy,** in Polymer Science and Technology, is a record of bonafide research wor carried out by him. **Mr. K. Senthil Kumar** has worked under our guidance an supervision and has fulfilled the requirements for the submission of this thesis, which t our knowledge has reached the requisite standard.

The results contained in this thesis are original and have not been submitted, i part or full, to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

Long fiber-reinforced thermoplastics (LFRT) have received much attention because of its possible processability by conventional technologies. The aim of this work is to develop long fiber reinforced polypropylene (LFPP) composites and to correlate the mechanical properties with its microstructure. The work has been carried out in four different phases. In the first phase, a radial impregnation die (RID) was designed and fabricated and retrofitted with an existing single screw extruder. The die was designed to have maximum possible impregnation of glass fiber roving with thermoplastic melt in the extruder. The quality of impregnation was assessed and the impregnated strands were chopped to 3 mm, 6 mm 9 mm and 12 mm length as discontinuous long fiber pellets. Processing these long fiber pellets in injection molding machine was the second phase of work. Fiber length distributions and fiber orientations were also analyzed. The third phase of the work concentrates on the static and dynamic mechanical properties of injection molded composites. Analyzing the LFPP composites for fracture toughness, fatigue and failure behaviour was the final phase of this research work. Structure-toughness relationship was correlated using microstructure efficiency concept. Fatigue life of LFPP composites were determined using tension-tension test method. Fatigue crack growth propagation was observed for different LFPP composites and correlated with microstructure. Failure behaviour was observed using SEM pictures. This work makes a useful experimental foundation in developing strategies with long fiber thermoplastic composites and to understand the relationship between its improved structure and properties.

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