

**DELHI TECHNOLOGICAL UNIVERSITY****(Formerly Delhi College of Engineering)****Bawana Road, Delhi-110042****CANDIDATE'S DECLARATION**

I Prashant Mani Shandilya, 2K16/PTE/04 student of M.Tech Polymer Technology hereby declare that the project dissertation titled “**Studies on Carbon Fiber Reinforced Polyurethane-Epoxy Composite: Mechanical Properties Evaluation**” submitted by me to the Department of Applied Chemistry, Delhi Technological University, Delhi in the partial fulfillment of the requirement for the award of the degree of Master of Technology in Polymer Technology, is original and not copied from any source without proper citation. This work has not previously formed the basis for the award of any degree, diploma, associate-ship, fellowship or other similar title or recognition.

Place: Delhi

**PRASHANT MANI SHANDILYA**

Date:

**DEPARTMENT OF APPLIED CHEMISTRY**  
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**CERTIFICATE**

I hereby certify that the project dissertation titled “**Studies on Carbon Fiber Reinforced Polyurethane-Epoxy Composite: Mechanical Properties Evaluation**” submitted by Prashant Mani Shandilya (Roll No.: 2K16/PTE/04), Department of Applied Chemistry, Delhi Technological University, Delhi in partial fulfilment of the requirement for the award of the degree of Master of Technology in Polymer Technology, is a record of the project work carried out by him under my supervision. To the best of my knowledge this work has not been submitted in part or full for any degree or diploma to this university or elsewhere.

Place: Delhi

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**Prashant Mani Shandilya**

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## **ABSTRACT**

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In this study, Hydroxyl-terminated polyurethane (HTPU) pre-polymer was used to increase the mechanical properties of Bisphenol-A based epoxy resin. Sample of neat epoxy, different ratio of polyurethane modified epoxy samples and same amount of carbon fiber in different directions was used to reinforce polyurethane modified epoxy samples and were compared on the basis of their properties. Tests showed the excellent improvements in properties of the composites made by polyurethane-modified epoxy resin and further improvement in properties when reinforced with carbon fiber. In this experiment, prepared composite samples have been tested for tension test, compression test and characterized by Fourier-transform infrared spectroscopy and Thermo-gravimetric analysis. Tests showed the improvement of tensile, compression and load bearing capacity of polyurethane-modified epoxy composite. Further load bearing capacity in tensile test was observed in composite when reinforced by carbon fiber in longitudinal direction. Increase in content of the PU pre-polymer has shown increase in compressive properties, making the samples more brittle than epoxy. While, samples prepared by reinforcing carbon fiber randomly showed good results as compared to the transverse direction. PU-modified epoxy samples did not much affected by thermal degradation, showing thermal degradation value of all samples nearly same. TGA for 5% PU-modified epoxy samples showed two step degradation while others sample showed single step degradation.

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## **LIST OF ABBREVIATION**

<b>Symbol</b>	<b>Notation</b>
CFRP	Carbon fiber reinforced polymer
OMC	Organic matrix composite
MMC	Metal matrix composite
CMC	Ceramic matrix composite
PMC	Polymer matrix composite
SMC	Sheet molding compound
GMT	Glass fiber mat reinforced thermoplastics
RTM	Resin transfer molding
PAN	Polyacrylonitrile
TETA	Triethylenetetramine
MDI	Methylene diphenyl diisocyanate
PEG	Polyethylene glycol
DMF	Dimethyl formamide
FTIR	Fourier transform infrared spectroscopy
TGA	Thermal gravimetric analysis
UTM	Universal testing machine
ASTM	American society for testing and materials