

# Multi-Scale Modelling for Polymeric Nano Composites

## Overview

High performance composites are widely used in aerospace, automotive, railways and other transport systems due to their superior mechanical properties and other functional properties such as high fatigue life, corrosion resistance, ease of manufacturing and maintenance. Since most of the fibers used as reinforcement, are costly and not easily available, the effective utilization of these materials become essential. Hence the study of mechanics of composite materials becomes important. The studies based on experiments become time consuming and expensive, hence numerical tools such as Finite Element Methods, Finite Difference Methods, etc., are used for the analysis. In this course, the participants will be exposed to the basic introduction of composite materials, characterization, applications and basic micro and macro mechanics analysis. Then the use of finite elements methods for composite analysis which will further be expanded to multiscale modelling along with molecular dynamics (MD) and coupling of different length and time scales. These techniques will be useful in modelling the polymeric composites with nano fillers as secondary reinforcing member for improved mechanical properties.

This course is organized in two modules that should be taken together. Module A mainly covers the topics introduction of nanocomposites, manufacturing, characterization methods and performance studies of nano-composites for structural applications. In Module B, the basic introduction of continuum mechanics along with finite element methods will be covered. Secondly, the molecular dynamics (MD), multiscale methods along with bridging of domains will be explored. Lastly few examples will be explained for understanding the given concepts.

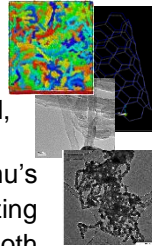
Course participants will learn these topics through lectures and handouts. Also case studies and assignments will be shared to stimulate participant's research motivation.

<b>Dates for the Course</b>	<b>16<sup>th</sup> January, 2017 to 27<sup>th</sup> January, 2017</b>
<b>Host Institute</b>	<b>IIT Madras</b>
<b>No. of Credits</b>	<b>2 (28 lecture hours)</b>
<b>Maximum No. of Participants</b>	<b>50</b>
<b>You Should Attend If...</b>	<ul style="list-style-type: none"><li>▪ Undergraduate, Postgraduate, Research Scientist from both mechanical and aeronautical discipline as well from industry interested in developing composite materials reinforced with nano-particles</li><li>▪ If you are working in an industry for developing numerical methods for characterizing the failure of composites both in Micro and nano scales</li></ul>
<b>Course Registration Fees</b>	The participation fees for taking the course is as follows: <b>Student Participants: Rs.2000, Faculty Participants: Rs.6000</b> <b>Government Research Organization Participants: Rs.15000</b> <b>Industry Participants: Rs.20000</b>
<b>Mode of Payment</b>	Demand draft in favour of "Registrar, IIT Madras" payable at Chennai. The demand drafts may be sent to the Course Coordinator whose address is given below.
<b>Accommodation</b>	The participants may be provided with hostel accommodation, depending on the availability, on payment basis. Request for hostel accommodation may be submitted through the link: <a href="http://hosteldine.iitm.ac.in/iitmhostel">http://hosteldine.iitm.ac.in/iitmhostel</a>

## Course Faculty



**Prof. SD Jacob Muthu** is from the Faculty of Engineering, University of the Witwatersrand,



Johannesburg, South Africa. Dr. Muthu's current research is focused on characterizing nano and hybrid composites using both experimental and numerical methods including multiscale modeling, molecular dynamics and cohesive zone modelling.

### Prof. Velmurugan



He is working as a Senior Professor in the Department of Aerospace Engineering, Indian Institute of Technology, Madras, India. He works on Composite Materials, Impact Mechanics and Nano Composites.

## Course Coordinator

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