Professional Education and Training

Short Course Programme

Failures, Reliability and Durability of Polymers

Introduction

Polymer materials, which are commonly used in thousands of products as plastics, elastomers, coatings and adhesives, are viscoelastic in nature. Their properties are highly time, temperature and stress dependents. The significance of this is often overlooked at the design stage. As a simple demonstration of the significance of this, the long term fatigue strength of polycarbonate is only 14% of the short term tensile strength quoted on manufacturers' data sheets. Hence, this course is design to provide general understanding of polymers as physical materials, their properties and failure mechanisms, their reliability data and existing technology that deliver their desirable durability characteristics and properties.

Designed For

This course has been designed for practicing engineers, analysts and managers to provide a general understanding of polymers, their failure mechanisms, reliability analysis method and methods that should be used in design and production processes to assure desirable durability characteristics.

Objectives

■ Understand what polymers are and what defines the major polymer groups (thermosets, elastomers, thermoplastic elastomers, amorphous thermoplastic and semi-crystalline thermoplastics) and the major properties of these groups. Define and analyse system requirements and to determine reliability and durability critical parameters

■ Understand the short term properties of polymers (stiffness, toughness, strength, HDT) and the effects of time and temperature on performance.

■ Understand polymer material selection, moulding and design features essential to ensuring the long term durability of engineering components

■ Perform Reliability Analysis of failure data

■ Make predictions regarding the future durability characteristics of a given polymer structures

Content

■ **Polymers and Polymer Structure**

- Mechanical Properties of Polymers
- Short Term Properties
- Long Term mechanical properties
- Thermal Properties of Polymers
- Chemical Resistance

■ **Common Polymer Materials and Structure**

■ **Design and Processing**

- Injection moulding overview
- Moulded Structures & Design for injection moulding
- Assembly techniques and design features

■ **Materials Selection Process**

- General selection by material structure
- Identification of candidate material types
- Identification of potential material types

Comparison of named grades.

■ **Failure Mechanisms**

- Thermal Degradation
- Photo-induced Degradation
- Chemical Degradation
- Oxidation
- Galvanic action

■ **Failure Cause**

- Incorrect material selection:
- Chemical & environmental interactions:
- Response to long term loads:
- Processing errors:
- Inappropriate design:

■ **Case Studies conducted by Independent Polymer Technology ltd (www.ipolytech.com)**

■ **Reliability Analysis of Failure Data**

- Weibull Method (analytical and graphical)

■ **Durability Prediction**

- Expected Time To Failure
- 5% and 95 % Life expectancy

Duration: 3 days

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Key Information	
Length	3 days
Dates	To be agreed
Time	0900 – 1700
Venue	Woodbury Park Hotel, Golf and Country Club –approximately eight miles by road from Exeter (the nearest major city).
Cost	£950.00 + VAT (tuition, course material, lunches and light refreshments)
Accommodation	Accommodation is not included in the course fee. Participants are responsible for the arrangement and payment of their accommodation. Reduced rates are available at Woodbury Park Hotel – contact Woodbury Park Hotel Reservations direct requesting the 'MIRCE' rate. Contact details are – Woodbury Park Hotel, Golf and Country Club, Woodbury, Exeter, EX5 1JJ, United Kingdom Tel +44 (0) 1395 233 382 Fax +44 (0) 1395 233 384 Email enquieries@woodburypark.co.uk Web www.woodburypark.co.uk A list of alternative accommodation in other hotels and guesthouses in the area of the course venue is available from MIRCE Akademy on request.
Booking	Please complete a Booking Form for each participant and return it to MIRCE Akademy – available to download at www.mirceakademy.com under heading Communication/Training.

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