

Polymers

Structure, Design, Processing, Durability & Reliability



Summer Schools 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 Durability and Reliability Analysis of failure data
- Make predictions regarding the future in-service characteristics of a given polymer structures and their specific applications and environmental conditions

24th MIRCE International Summer School

16 - 18 July 2013, Woodbury Park, Exeter EX5 1JJ, United Kingdom

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.

Consequently, this Summer School is design to provide a general understanding of polymers as physical materials, their design and processing properties and the common failure mechanisms. This knowledge is then used to assist in assessing the durability, reliability data and existing technologies that deliver desirable durability characteristics.

Designed For

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

Polymers Considered

- Poly ether ether ketone (PEEK)
- Fluorinated Polymers e.g.
 - PTFE
 - PFA
 - PVDF
 - FEP
 - ETFE
- Poly phenylene sulfide (PPS)
- Poly vinyl chloride (PVC)
 - Plasticised
 - Un plasticised
- Poly ether imide
- Polyamides
- Polycarbonate
- Polystyrene and derivatives:
 - ABS,
 - SAN
 - others
- Polyoxymethylene (Acetal) and its copolymer
- Polyolefins

and many more....

Participants are welcome to bring their own polymers for discussion.

Programme

Content

■ Polymers Definition

■ 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

- Processing methods overview
- Moulded Structures
- Design for injection moulding
- Assembly techniques
- 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
- Environmental Stress Cracking (ESC)

■ Failure Causes

- 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 approach
 - Graphical approach

■ Durability Prediction

- Failure Function
- Failure Density
- Expected Life
- 5% Life
- 95 % Life
- Reliability Function

24th MIRCE International Summer School

16 - 18 July 2013, Woodbury Park, Exeter EX5 1JJ, United Kingdom

Host and Presenter Dr Jezdimir Knezevic



Researcher, educator and entrepreneur with over 300 publications disseminated world-wide through books, handbooks, papers, monographs and reports are attributed to his name. In addition, he has delivered hundreds of technical presentations, key note addresses and speeches; has been congress, conference, symposium chairman, track leader, workshop presenter, round table moderator on many hundreds international events which took part in all continents.

Dr Knezevic is the father of **Mirce Mechanics**, the science of the motion of functionability through the life of functional systems. He is the Founder and President of MIRCE Akademy, an independent research and educational institution based in UK.

His multi-disciplinary theoretical knowledge, considerable “hands-on” practical experience and endless passion for the subject have attracted over 6000 engineers, managers and students to his courses and educational programmes in over 40 countries in Europe, North and South America, Asia, Australia and Africa, at universities, professional institutions, industry and government.

Dr Knezevic has worked in the field of the system functionability theory and its applications to engineering and management for over 30 years.

Full details www.mirceakademy.com

Polymers Specialists



Gary Howe
Managing Director of
Independent Polymer
Technology Ltd., Telford,
UK and Science Fellow of
the MIRCE Akademy.

Gary graduated in Material Science from the University of Bath and founded ipolytech in 2003 after a varied career in polymer technology. His previous roles have included: Managing component development projects for flat panel loudspeakers at NXT Ltd; Materials Engineer responsible for non-metallic materials systems for Harrier and European Fighter developments at British Aerospace Military Aircraft Ltd; Research on in-field damage repair of fibre reinforced composites and on the electropolymerisation of polymethyl methacrylate onto continuous carbon fibre tows at Royal Aerospace Establishment Farnborough. Gary also previously worked for nearly 10 years at Rapra Technology Limited where he managed a team of consultants as Head of Plastics Technology.



Justin Taylor
Consultant at Independent
Polymer Technology, Ltd.,
Telford, UK and Science
Fellow of the MIRCE
Akademy.

Justin graduated from University of Wales, Swansea in Materials Engineering. He joined ipolytech in 2008 with experience gained from previous roles including: managing the development and construction of a bespoke production facility to manufacture a range of high-pressure hoses for the oil and gas industry. Justin has also managed the laboratory and the materials at Tronic Ltd, providing in-house technical support on sub-sea electrical connectors and as a senior consultant at Rapra Technology he delivered training courses in the UK and in Europe. Justin has particular expertise in the field of environmental stress cracking of amorphous thermoplastics and has publications on ESC of polycarbonate in binary liquid mixtures.

Full details at www.ipolytech.com

Venue

Woodbury Park is a magnificent 500 acre leisure and sporting complex set among green rolling hills above the South West English coastline, only a few miles from the ancient city of Exeter.

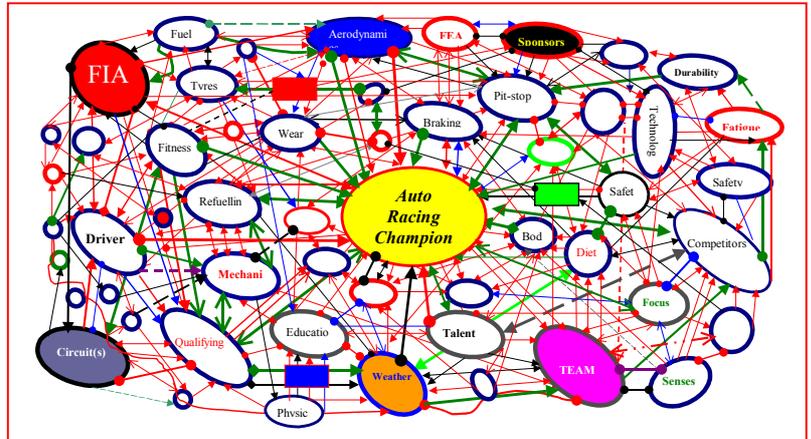
Communication between Exeter and other parts of the United Kingdom are excellent.

By road, the M5 motorway links Exeter to London, the Midlands, Scotland and Wales. Regular rapid coaches run services to and from London and Heathrow Airport.

By rail, a regular fast service is available to and from Exeter (St David's Station) and London (Paddington Station).

By air, Exeter Airport, which offers regular flights to many British and Continental destinations is 5 miles from Woodbury Park.

Travel between Exeter and Woodbury requires a car or taxi and takes about thirty minutes. Among the outstanding leisure facilities at Woodbury Park are two golf courses including the magnificent Oaks Championship course, tennis courts, a swimming pool, spa, sauna and fully equipped keep fit centre.



Auto Racing Championship Centre is a part of the MIRCE Akademy that is established in June 2013 to facilitate Mirce Mechanics based research leading to development of the methods and tools for further enhancement of the Reliability and Effectiveness of the following types of auto-sport:

- FIA Formula One World Championship
- FIA World Rally Championship
- FIA World Endurance Championship
- FIA World Touring Car Championship

The Centre provides a science-based dynamic educational display related to the reliability and effectiveness of FIA World Championship Systems, listed above, which is continuously available to the general public courtesy of the Woodbury Park Hotel



Woodbury Park Hotel & Golf Club, Exeter, EX5 1JJ, UK – home of the MIRCE Akademy

Key Information

Price (GB Pounds £)

Package Type	Fee	VAT	Total
Participant	950.00	190.00	1140.00
MIRCE Fellow	900.00	180.00	1080.00
MIRCE Member	850.00	170.00	1020.00
MIRCE Student	750.00	150.00	950.00

The Price includes:

- Tuition
- Study Materials
- Lunches
- Light Refreshments
- Summer School Dinner on 18th July
- Visit to the MIRCE Akademy Auto Racing Championship Centre

Group Discounts for Standard Participants

Groups of 3 or more booking at the same time from the same organisation will receive a 15 % and for 5 or more there will be a 25% discount.

Location and Accommodation

The Summer School will be held at **Woodbury Park Hotel, Golf and Country Club**, which is approximately eight miles from Exeter by road.

Participants are responsible for the arrangement and payment of their own travel and accommodation.

Participants wishing to take advantage of preferential room rates should contact Woodbury Park Hotel Reservations quoting 'MIRCE'.

The 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 enquiries@woodburypark.co.uk
Web www.woodburypark.co.uk

A list of alternative accommodation in other hotels and guesthouses in the vicinity is available from MIRCE Akademy on request.

Travel

For travel details to Woodbury Park and a map visit our website at www.mirceakademy.com.

Messages

During the Summer School participants may be contacted by telephone on +44 (0) 1395 233 856 or by fax on +44 (0) 1395 233 899. Messages will be passed to participants during breaks

Language

The Summer School language will be English.

Recommended Attire

Smart casual is the recommended dress code for the Summer School and in the grounds of Woodbury Park.

No formal dress is required for the Summer School Dinner.

Smoking

Woodbury Park does not permit smoking in any of the leisure and sport complex facilities and in the hotel.

Mobile Phones

Out of consideration to speakers and the audience, mobile phones should be switched off during the formal sessions.

Further Information

 +44 (0) 1395 233 856
 quest@mirceakademy.com
 www.mirceakademy.com

