Materials Characterization to Aid Problem Solving

An IMS Industrial Affiliates Program Short Course

ARE YOU BATTLING MATERIALS CHALLENGES IN YOUR PRODUCTS OR PROCESSES?

If you answered yes, the following types of questions are likely all too familiar:

- Why does my product perform correctly sometimes and not others?
- Is my raw material consistent?
- Why are parts produced today cracking when the same tools and operating conditions produced good parts yesterday?
- Is this material what it is supposed to be?
- How can I tell if this has been properly tempered/cured/annealed?
- Why is this component sticking when it is not supposed to?
- Why are there spots on the final product?

Did you know that materials characterization can often answer the "how" and "why" so that corrective actions can be more effectively targeted?

This five-day short course is designed to provide you with:

- a survey of the analytical techniques commonly used for materials characterization
- an understanding of what they measure and the nature of data collected
- capabilities, advantages, and limitations of each technique
- how to use these techniques to clarify the complex relationship between material, processing and product variation
- examples of how these techniques, when used alone or in combination, solve real-world challenges for a variety of different material types such as polymers, metals, and ceramics

A comprehensive course book and daily mock troubleshooting exercises will help you to gain the confidence needed to apply the knowledge gained immediately at work.

EXAMPLE 1

A manufacturer had been working successfully with a supplier of steel shafts for years; however, the recent lot fractured very quickly in use. A call to the supplier indicated no changes to their process.

Analysis revealed material composition was the same but subsurface hardness had changed. Microscopy showed sharp features which increase stress concentration and facilitate rapid crack growth.

An internal investigation showed process improvement efforts had reversed two steps and modified a machining process. These changes resulted in the observed property changes and led to the premature failures.

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ANALYTICAL TECHNIQUES INCLUDE:

- Optical & Electron Microscopy
- Auger Electron Spectroscopy (AES)
- Scanning Probe Microscopy (SPM)
- Differential Scanning Calorimetry (DSC)
- Gas Chromatography/Mass Spectrometry (CG/MS)
- Nuclear Magnetic Resonance (NMR)
- Rheological Testing
- Energy Dispersive X-Ray Analysis (EDX)
- X-Ray Photoelectron Spectroscopy (XPS)
- Thermal Gravimetric Analysis (TGA)
- Fourier Transform Infrared Analysis (FTIR)
- X-Ray Diffraction (XRD)
- Gel Permeation Chromatography (GPC)

WHO SHOULD ATTEND

This course is appropriate for engineers, scientists and operations personnel with technical backgrounds involved in short-term problem resolution or longer-duration research or development projects. Familiarity with basic material properties is required.

INSTRUCTORS:

This course is taught by faculty and lab managers at UConn's Institute of Materials Science. The Institute is home to the Industrial Affiliates Program, an industry outreach program that has, for over forty years, assisted industry with short-term projects improving and trouble-shooting new and existing products. Our lecturers have extensive experience in materials characterization and its application to industrial challenges.

Example 2

A purchased part was not adhering as well as it had in the past. Contact angle measurements confirmed the new part had a lower surface energy. XPS and CG/MS examination showed this was caused by a low surface energy contaminant. This contaminant was traced to a manufacturing process change.

WHO WE ARE

The Institute of Materials Science (IMS) at the University of Connecticut Storrs campus is known internationally for research in the interdisciplinary fields of materials science and engineering, superior graduagte research educations, and technical outreach to industry.

Over 200 faculty members and graduate students from twenty departments, including UConn Health Center, are affiliated with IMS and contribute to the Institute's interdisciplinary research programs. Primary disciplines represented are chemistry, physics, chemical engineering, materials science & engineering, polymer science, pharmacy, molecular and cell biology, mechanical engineering, electrical engineering, biomaterials, and biosciences.