

Media release

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«Technology Briefing» on surface analysis

Looking at the “faces” of materials

Material analysis is a broad field which utilizes a wide range of different methods, and deciding which one is the most appropriate for a particular problem is often difficult, even for the experts. The one-day meeting on “Material Analysis in Thin Films, Surfaces and Boundary Layers”, held on 29th October at the Empa Academy in Duebendorf, helped shine a great deal of light on this issue.

Thin films, surfaces and boundary layers; every day we come into contact with them without actually being aware of the fact. "Surfaces represent the faces of materials," maintained Joerg Patscheider, Empa thin-film specialist. "When we need to deal with a material, we have to get to grips with its surface. The only part of an implant that the body sees, for example, is its surface." And it is its surface properties which determine whether the body accepts or rejects an implant, so it is essential that the characteristics of the surface be thoroughly understood. It is important to know if it is composed of the required material – stainless steel or titanium in the case of implants – and if there are any unwanted materials contaminating its surface. These questions can be answered by surface analysis techniques employing sophisticated instrumentation, and the most important methods were demonstrated at the meeting.

Boundary layer problems – potentially very expensive

Boundary layers are also critically important, because they determine whether or not the surfaces of two layers, typically a surface coating and the substrate material underneath it, will adhere to each other. Surfaces which separate during use can have catastrophic consequences, as Empa researcher Roland Hauert showed with the help of several real-life examples. One case involved superhard coatings (such as have long proven themselves on drill bits or in motors) which detach from implanted artificial hip joints sometimes after years of use. The reason was found to be a specific type of corrosion which attacked the adhesive boundary layer, triggered by aggressive bodily fluids. Not infrequently are problems with boundary and surface layers responsible for bringing entire production lines to a halt, Hauert added, damage which can rapidly result in very high costs due to liability issues and manufacturing downtime.

Every method has its own individual peculiarities

Phillip Willmott, a researcher at the Paul Scherrer Institute (PSI), gave a presentation introducing the «Swiss Light Source» (SLS), one of PSI's large scientific systems. The SLS makes it possible for researchers to visualize the hidden properties of materials using synchrotron radiation, an intensive form of light invisible to the human eye. Very reliable results are possible which generally cannot be achieved by any other method. And as Giorgio Travaglini, Head of Technology Transfer at PSI, added, the SLS is "not just a play thing for the physicists – it is also available for other users."

Antonia Neels, Head of Analytic Processes at the «Centre Suisse d'Electronique et de Microtechnique» (CSEM), described to the audience analytical methods using x-ray diffraction and microscopic techniques. These find applications primarily in the development of modern surface coating methods. Neels summarize her work in the following words: "The aim is to understand the processes".

The «Technology Briefing» at Empa appealed in the first instance to specialists from industrial organizations, for whom this event provided an overview of the wide range of analytical competences and instrumentation available within a small area in Switzerland. The opportunities available at Empa, PSI and CSEM were described, and the pros and cons of each of the analytical methods discussed were considered in detail both during the presentations and in the following question-and-answer sessions. Juergen Ramm of Oerlikon Balzers AG congratulated the host for having had the excellent idea of organizing such an event, commenting that "developments in the field of surface science are not possible without access to good analytical techniques." The seminar offered a comprehensive overview of the methods available to meet exactly this requirement from industrial partners.

Further information

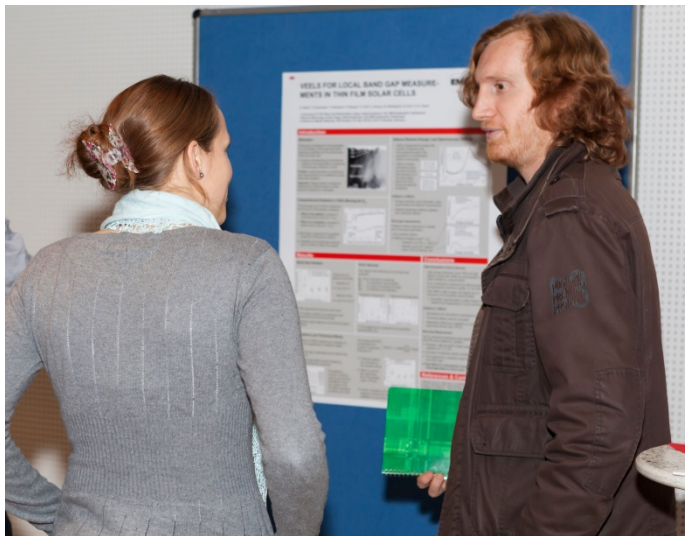
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Antonia Neels of CSEM describing various x-ray diffraction techniques suitable for use in modern surface coating processes.



The poster session during cocktails after the seminar offered an excellent opportunity to discuss the presentations.

These images can be downloaded from www.empa.ch/bilder/2013-10-31-MM-Materialanalytik.