Nanoindentation – from basics to advanced applications

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Specific objectives of the course:

1. To understand the basics of nanoindentation, including the Oliver-Pharr method;
2. To understand the best practice procedures, factors affecting results and the main experimental challenges associated to the method;
3. To understand the modelling/experimental procedures for the application of nanoindentation to the assessment of mechanical properties in thin films and coatings;
4. To understand the most recent advances of nanoindentation testing, including high-speed and dynamic nanoindentation.

Course Abstract:

The course aims to provide students, researchers with a comprehensive overview on the basics and recent advances of nanoindentation testing, with specific focus on nanoindentation of thin films, coatings, and engineered surfaces. First, a comprehensive overview will be given on the most used data interpretation method for calculation of hardness and elastic modulus (Oliver-Pharr), together with a detailed description of all the most critical experimental issues, calibration procedures, best practice guideline. Then, the main focus will be on the nanoindentation data analysis and modelling for the correct quantification and interpretation of the nano-mechanical behavior of thin films and coatings. Finally, the course will introduce the most recent developments of the method, including (a) fast and high-throughput mechanical micro-probing, (b) nanoindentation at high temperatures, (c) use of nanoindentation to measure fracture-toughness and strength at the nano-scale and (d) use of nanoindentation to measure surface free energy in hydrophobic coatings and nanopatterned surfaces.

Lectures:

1. **Introduction to nanoindentation: Oliver-Pharr method and dynamic stiffness measurement;**
2. **Practical experimental procedures and factors affecting results;**
3. **Nanoindentation of thin films and coatings;**
4. **Next generation of nanoindentation.**

Who should attend:

Mostly, PhD students and post-docs working in the field of surface engineering, technicians and engineers interested in nano-mechanical characterisation of engineered surfaces. Senior experts of coating and surface modification technologies. Companies interested in surface mechanical characterisation.