Nano-Tribology

Ph.D winter school January 16 to 27, 2012

Organised by ESF FANAS and the Technical University of Denmark

Deadline for applications: December 9, 2011

Technical University of Denmark, Mechanical Engineering Department
Building 427S, DK-2800 Lyngby

Language:	English	**Point (ECTS):**	5
Form:	Lectures and invited speakers. Project work		
Examination:	Report and oral examination on Friday January 27, 2012.		
Aid:	Allowed.		
Evaluation:	Passed/Not Passed. External examiner		
Qualified prerequisites:	Basic skills in solid mechanics and fluid mechanics.		
Participants restrictions:	Minimum 8, maximum 24.		
Application:	Deadline December 9, 2011.		

Tribology is the science and technology of surfaces in relative motion. This discipline which involves friction, lubrication and wear plays a crucial role in both research activities and practical applications. The interest in nanotribology has been increased during the last decade as the size of parts in micro/nano devices is continuously decreasing. In spite of this the fundamental mechanisms behind tribology are practically undiscovered except in the case of hydrodynamic lubrication.
An intense research effort to reveal the tribological origins was initiated 15-20 years ago by several physical and chemical societies all over the world. The new research angles were the increasing possibilities to observe surfaces at the nano-scale and the rapidly increasing computer processing capacity for simulations.
The nanotribological research has not yet solved the tribological challenge but has and is still clarifying elements of the sliding friction and wear puzzles: These are the topics of the present course.
The course is of interest for any Ph.D students having surfaces in relative motion as part of their study, which is the case for most Ph.D students in engineering, physics, chemistry or biology.

List of lecture topics in 2011, could be updated for 2012:

- Introduction to nanotribology with a state of the art overview of the stage of the research.
- Nanotribological contact mechanics.
- Nanotribological simulations and theories. Computer modelling.
- Examples of nanotribological experimental methods: The friction force microscope (FFM) and the Surface Force Apparatus (SFA).
- A number of applications including:
  - Nanotribological investigations of the lubricity of Dimethyl Ether (DME) at DTU.
  - Theory of rubber friction with applications to the tyre and the medical industry.
  - Friction of polymers with application to the medical industry.
  - Surface characterisation.
  - Bio-lubrication.

Invited guest lectures in 2011 included:

Prof. B.O. Jacobson,	University of Lund, Sweden.
Dr. B.N.J. Persson,	Institut für Festkörperforschung Teori 1, Forschungszentrum Jülich, Germany.
Dr. E. Gnecco,	IMDEA Nanociencia, Madrid, Spain.
Dr. C. Drummond,	Centre de Recherche Paul-Pascal CNRS, Pessac, France.
Seunghwan Lee	Associate Professor, Mechanical Engineering, Technical University of Denmark.
L. De Chiffre	Professor, Mechanical Engineering, Technical University of Denmark.

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Fee: 350 € including course material and lunches.