

Nano-Tribology



Ph.D winter school January 18 to 29, 2010

Deadline for applications: November 6, 2009

**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 29, 2010.		
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 November 6, 2009.		

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 2009, could be updated for 2010:

- 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.
- An example of nanotribological experimental method: The friction force microscope (FFM).
- A number of applications including:
 - Nanotribological investigations of the lubricity of Dimethyl Ether (DME) at DTU.
 - Theory of rubber friction at the nano-scale with applications to the tyre and the medical industry.
 - Friction of polymers with application to the medical industry.
 - Micro/nano processing: A research area at DTU.

Invited guest lectures in 2009 included:

Prof. B.O. Jacobson, University of Lund, Sweden.

Dr. U. Tartaglino, Scuola Int Super Studi Avanzati, SISSA, Trieste, Italy and Forschungszentrum Jülich, Germany.

Dr. B.N.J. Persson, Institut für Festkörperforschung Teori 1, Forschungszentrum Jülich, Germany.

Dr. E. Gnecco, University of Basel, Switzerland.

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Fee: 350 € including course material and lunches.