Surface science for the environment 001-2-4047

3 credits course, Prof. Iris Visoly-Fisher

Objectives:
Surfaces play a crucial role in many phenomena, in particular in nano-sized materials where surface atoms constitute a large fraction of the particle atoms. The course objectives are: (1) The student will understand the structure and properties of surfaces and how they affect the properties of materials; (2) The student will be able to select surface-specific characterization methods to study surface structure, composition and properties; (3) The student will describe applications of surface science phenomena in environmentally-relevant materials and devices.

Course description:
Introduction to surface science (lectures 1-5) ; Experimental methods in surface studies (lectures 6-12); Topics and applications of environmental surface science (lectures 13-14)

Prerequisites: Physics 1, General Chemistry, Thermodynamics (or equivalent course)

Literature:

1. Introduction to surface chemistry and catalysis /Gabor A. Samorjai, New York : Wiley, 1994
2. Physics and chemistry of interfaces /Hans-Jurgen Butt, Karlheinz Graf ,Michael Kappl .Weinheim : Wiley-VCH, 2006
3. Physical chemistry of surfaces /Arthur W. Adamson and Alice P. Gast New York : Wiley, 1997 and past editions
4. Recent relevant journal papers

Tentative lecture schedule:
1 - Introduction, liquid surfaces,
2 - Wetting and contact angles
3 – Solid surfaces.
4 – Adsorption
5 - Colloids, nanoparticles and porous materials + assignments of final project topics and explanations
6 – Electronic and optoelectronic properties of surfaces and interfaces + assignments of final project topics and explanations
7- Light and its Spectroscopy for surface characterization (FTIR, ATR-FTIR, PMIRRAS, PL, confocal, XRF?)
8 – Characterization of surface composition using photoelectron spectroscopy (XPS, UPS)
9 - Characterization of surface composition using ion and electron spectroscopy (SIMS, EDS, AES, SAM).
10 - Surface structural characterization using electron microscopy (SEM) and scanning probe microscopy (AFM, STM)
11 – Experimental characterization of electronic and optoelectronic properties of surfaces (KFM, SCM, SSR etc).
12 - Tour IKI surface characterization labs (Be'er Sheva campus): AFM, SEM, XPS
13 – Final project presentations
14 – Final project presentations

Grading: Homework: 25%. To be presented in class.
Final project (20-30 min lecture in class): 25%. Peer-teaching of a surface topic of choice.
Home exam: 50% - analyzing a contemporary research topic