Environmental Interfacial Chemistry

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Surface or interfacial science is the study of physical and chemical phenomena/interactions that occur at the interface between two phases of the matter. The power of this type of science arises from the fact that all interactions between different materials start at the interfacial region. The surface molecules play the major role of the interaction. Surface properties like roughness, terraces, pores, functional groups, charge, etc., affect the interaction path and dynamics. Surface science has become important to the fields of surface engineering, heterogeneous catalysis, electrochemistry geochemistry and atmospheric physics and chemistry. It has many applications in the heterogeneous catalysis, semiconductor device fabrication, fuel cells, and adhesives.

The course will introduce the students to the surface chemistry from the history onward to the industrial and environmental applications. The different surface interactions and surface analytical technique will be demonstrated. Finally, a specific case study on investigating ice nucleation in atmosphere will be given as an example of the applications of surface chemistry in environmental science.

Monday, 18th February 2019, 12-16, room 222/II

Lecture 1 (History and background)

- The history of surface chemistry starting from the work of Paul Sabatier, Fritz Haber and Irving Langmuir on heterogeneous catalysis, Haber process and Langmuir adsorption equation.
- The three most related fields to surface chemistry (Catalysis, Electrochemistry and Geochemistry)

Tuesday, 19th February 2019, 8-13, room 222/II

Lecture 2 (Analysis techniques)

- Surface characterization techniques (e.g. X-ray photoelectron spectroscopy, scan electron microscopy and atomic force microscopy)
- Optical techniques (e.g. Reflection-absorption infrared, dual polarisation interferometry, surface enhanced Raman and nonlinear optical spectroscopy)
- Electrochemical techniques (e.g. Streaming potential and zeta potential)

Wednesday, 20th February 2019, 8-13, room 222/II

Lecture 3 (Case study)

- Application of nonlinear optical spectroscopy to understand the origin of the effect of surface charge on the ice nucleation properties of relevant atmospheric aerosols.