理工情報生命学術院共通専門基盤科目

0AH0315 生物環境工学特別講義Ⅰ (1 単位)

Please register (履修登録期間 7 月 27 日～8 月 24 日)

講師　**Prof. Jérôme F.L. DUVAL**

https://elkin2019.mit.edu/duval/
CNRS Research Director at the National Center for Scientific Research (CNRS)

Date　August 31, September 21, September 27, September 28

Time　14:30 – 18:00　(tentative)

On line　Zoom Code will be announced after your register

コロイド界面の基礎と応用

- The basics of electric double layers at colloid/solution interfaces and the basics of interactions between hard colloids;
- The basics of electrokinetic phenomena (DC electrophoresis, streaming current, streaming potential), and the fundaments of the theories required for a proper interpretation of electrokinetic data collected on hard, soft particulate and planar surfaces (appreciation of the conditions that warrant adequate application of the theories);
- The origin of the 'unconventional response' of soft surfaces to applied electric fields and applied tangential flow;
- Be able to formulate a proper experimental plan for measurements of soft particle/surface electrokinetics;
- Basis of cell adhesion to surfaces and the useful (or not) information derived from electrokinetic studies;
- Metal transfer dynamics to biointerfaces, and the necessity to address electrokinetic properties of the involved colloidal interfaces;
- The dynamic complexation of metal ions by colloids and nanoparticles and the necessity to address electrokinetic properties of the involved colloidal interfaces.

COURSE DETAILS (15 HRS LECTURES IN TOTAL)

***PART I of the course*: Past and recent developments in the field of particle and surface electrokinetics with an emphasis on the differentiated electrokinetic behavior of hard and soft colloidal systems.**

Lecture 1. Introduction to Electrokinetics of Colloids and Surfaces

- Introduction & short overview of the overall course content
- Basics of electric double layers (case of hard particles)
- Basics of particle interaction theory & application to colloid stability against aggregation
- Electrokinetics of hard interfaces: theory and illustrations

Lecture 2. Electrokinetics of soft (bio)interfaces

- On the applicability of the zeta-potential concept for soft (bio)interfaces
- Streaming-potential & streaming current of planar polymer-like interfaces: theory and concrete case studies (polymer thin films), Importance of surface conductivity phenomena
- Electrophoresis of porous particles and polymer-coated particles : theory and case studies (bacteria, viruses, hydrogel-like particles)
- The exciting case of charge-stratified soft interphases (polyelectrolyte multilayers, zwitterionic particulate interphases)

***PART II of the course*: Electrokinetics and (nano)particles reactivity in the contexts of cell adhesion to surfaces, dynamic complexation of metal ions by colloids and nanoparticles, and transfer of metal ions to and across biointerfaces.**

Lecture 3. Electrokinetics as a tool for assessing bioadhesion capacity ?

- Basics of cell adhesion to surfaces: nature of the interactions coming into play
- Quantifying the cell-surface interactions with use of electrokinetics : potentialities and limits
- Atomic Force Microscopies as nano-tools for addressing bioadhesion at the nanometric scale
- Case studies from recent literature

Lecture 4. Dynamic complexation of metal ions by colloids and nanoparticles

- Basics : Eigen mechanism, thermodynamic *versus* dynamic metal speciation approaches
- On the importance of electrokinetics for rationalizing charge effects in chemodynamics of metal-(nano)particle complexes:

- Chemodynamics of metallic complexes: concepts, theory and computational illustrations
- Case studies from recent literature

Lecture 5. Transfer dynamics of metal ions to and across biointerfaces

- Basics of reactive transfer of metals to biointerfaces: the importance of electrostatics as addressed by electrokinetics
- Modern aspects of theory on metal transfer dynamics to bio-cells: going beyond the thermodynamic paradigms (biotic ligand model)
- Case studies from recent literature

世話人　足立泰久　（adachi.yasuhisa.gu@u.tsukuba.ac.jp）

聴講のみ希望する場合は足立まで（氏名、所属）をメールで連絡をください。

資料と Zoom コードを送ります。