27 Nov - 01 Dec 2011, Fiesta Americana Condesa Cancun All Inclusive Resort, Cancun, Mexico

High-T Interfacial Forces, Energies and Phenomena

By Dr. George Kaptay

Short Course: 27 Nov 2011, Americana Condesa Cancun All Inclusive Resort, Cancun, Mexico

Learn about interfacial phenomena and on the 8 different interfacial forces causing them. Learn also on interfacial energies, as interfacial forces depend on them. Emphasis is on high-temperature materials interfaces, such as liquid metals, molten salts, slags, ceramics, solid metals and gases/vapours. Case studies will be analysed from metal production technologies, including latest developments on metal matrix composites and particle stabilized metallic foams and emulsions.

Participants are encouraged to raise interfacial phenomena related questions relevant to their own experience and problems to be solved. George will be available for discussions during the networking breaks and after the course. Questions and desired topics are welcome prior to the course at mkaptay@hotmail.com.

Who Should Attend

This course would be beneficial to engineers, technologists and even PhD students involved in the development of metal production technologies. Recognised or not, all of those technologies are dependent on interfacial phenomena. Among all materials, metals are most sensitive to the effect of interfaces due to the highest among all material types interfacial energy in metallic systems.

Course Outline

This course is designed to develop a better understanding of interfacial phenomena, interfacial forces and interfacial energies with an emphasis on high-temperature systems.

Topics Include :

- Basics. Thermodynamic and mechanical definition of interfacial energy (tension). The Gibbs energy of phases taking into account the effect of interfaces + its consequences: equilibrium shape (including super-non-wettability and super-wettability), equilibrium size, interface restructuring, adsorption, segregation, Marangoni convection, surface phase transition, nucleation
- Forces. General equation for interfacial forces. The interfacial anti-stretching force (Young). The curvature induced interfacial force (Laplace) and thermodynamic consequences (nano-phase diagrams). The interfacial gradient force (Young- Goldstein-Block). The interfacial spreading force

(Marangoni). The interfacial capillary force (Young-Laplace). The interfacial meniscus force (Nicolson). The fluid (liquid or gaseous) bridge induced interfacial force (Naidich). The interfacial adhesion force (Hamaker, Derjaugin).

- Energies. Simplified models for interfacial energies (molar surface area, interfacial excess enthalpy and entropy). Application to liquid/vapour, solid/vapour, liquid/liquid, solid/liquid interfaces of high-T systems (including liquid metals, molten salts, solid metals, ceramics and gas/vapour phases). Size dependence of interfacial energies (for nano-systems). The Gibbs approach and the Butler approach to describe the concentration dependence. Segregation and surface phase transition.

The participants will also receive:

- CD with course material
- Certificate of completion
- PDF files (on the same CD as above) of the instructor's recently published articles related to interfacial phenomena
- Lunch and refreshments

Course Instructor Dr. George Kapta y

Dr. George Kaptay is a former professor and head of Department of Physical Chemistry and the present part-time professor and head of the Department of Nanotechnology at the University of Miskolc, Hungary. Dr. Kaptay is also the founding director and presently the scientific vice director and head of Department of Nano-composites of the BAY-NANO research institute on nanotechnology within the campus of the University of Miskolc, Hungary.

Dr Kaptay holds MSc and PhD degrees in metallurgical engineering (Leningrad, Russia) and a DSc degree in Interfacial Phenomena (Academy of Sciences, Budapest, Hungary). His research interests include interfacial phenomena, chemical thermodynamics, electrochemical synthesis, nanotechnology, transport phenomena. He has authored 260 papers, including a review chapter on Interfacial Forces in the Taylor & Francis reference book for Health Sciences (2009). He has held visiting professor appointments at the University of Alabama (USA), Kyushu Institute of Technology (Japan) and Swinburne University of Technology (Australia). Earlier versions of a similar course were presented by him at Kyushu (2004), Melbourne (2007) and at the EUROMAT conferences in Prague (2005) and Glasgow (2009).

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