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Flotation Chemistry and Mineral Processing

Xuming Wang, PhD
Department of Metallurgical Engineering
University of Utah
Research Interests

- The research activities involve both fundamental and applied aspects of Mineral processing, and surface & colloid chemistry in the development of flotation technology,
- Flotation Chemistry of sulfide and nonsulfide mineral
- Molecular Dynamics simulation
- Hydrometallurgy
- Waster water treatment and recycling
Surface Chemistry Lab

ZetaPALS Zeta Potential Meter

Surface tension meter

LB film deposition

Contact angle meter
Determination of Flotation Mechanism

- Characterization
- Hydrophobicity
- Electrokinetic Studies
- Adsorption
- Interaction Forces
Spectroscopy Lab

Adsorption

- Infrared Spectroscopy
  - Ex-Situ (without aqueous phase)
    - Transmission
    - Diffuse Reflectance
  - In Situ (in presence of aqueous phase)
    - Internal Reflection Spectroscopy
In-situ FTIR/IRS

Real-time Spectra Data

**Quantification**
- Adsorption Density
- Adsorption Kinetics
- Adsorption Isotherms

**Specification**
- Chemisorption
- Physiorption
- Precipitation

**Orientation**
- Conformation
- Orientation Angle
- Aggregation State
SFVS is a surface-specific technique that provides vibrational spectra of molecules at interfaces. It relies on the non-linear optical phenomenon of sum frequency generation.
SFG is a Powerful tool to Analysis Molecular Adsorption Structure at Interfaces
Atomic Force Microscopy (AFM) Lab.

Instrument used to measure properties of Surfaces
AFM Topography Image
Surfactant Head group Effect
Hydrophilic Mica Surface

Tertiary amine – dodecyl dimethyl ammonium hydrogen chloride, short cylindrical worm like structures

(200 nm scan)
A Typical Colloid Probe
Force measurement between a particle and air Bubble
Molecular Dynamics Simulation (MDS)

MD simulation of 40 DDA molecules near a quartz surface at pH 10

Monolayer formation

Red: Oxygen
Yellow: Silicon
Blue: Nitrogen
Green: Sodium
Flotation Principles

- Air is dispersed in the suspension. Hydrophobic particles attach to air bubbles and are collected in a froth phase while other hydrophilic particles remain in suspension.
Metal Recovery

Exploration

Mining

Crushing and Grinding

Refining

Flotation
Waste Water Treatment

Flocculation and Flotation
Waste Paper Recycling

Deink Flotation

Many types of paper are subject to a deinking step in order to remove ink from the waste paper in preparation for producing new paper. Several processes are used, most commonly flotation or washing.
Contact Information

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➢ Journal of Chemical Engineering & Process Technology

➢ Journal of Material Sciences & Engineering

➢ Journal of Nanomaterials & Molecular Nanotechnology
Powder Metallurgy & Mining Related Conferences

- 3rd International Conference and Exhibition on Material Science and Engineering 2014, San Antonio, USA
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