# Center for Advanced Studies in Novel Surfactants (CASNS)

**In 2008, CASNS was absorbed into CPASS (the Center for Particulate and Surfactant Systems), also at Columbia University*

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## Greener, More Sustainable Solutions for the Mining Industry

Mineral separations have been becoming increasingly challenging due to the emergence of problematic ores in several existing operations. It is well known within the mining industry that in selective flotation separation of valuable minerals from complex ores, certain silicates and slime-forming minerals have significant detrimental effects. Until recently, such effects were attributed to chemical factors such as heterocoagulation between the silicates and valuable minerals, which is generally referred to as slime coating. Previous approaches to this slimes problem have been unsatisfactory because they consume too much energy and water and are not sustainable.

Researchers at CASNS, in cooperation with Cytec Industries and centers' sponsor Vale-Inco, have developed new techniques to study rheological properties of such ore pulps. This research program, which was designed to develop a scientific understanding of contributions from both physical and chemical factors of slimes to selective mineral separation and suspension rheology, has discovered the large role played by morphology of certain silicate minerals, when present in even small amounts in a complex mixture of minerals.

*Less harmful sludge and more efficient separation of valuable minerals from complex ores leads to greener and more profitable mining.*

When the CASNS research program was initiated, there were no established methods to monitor the rheological properties of ore pulps, which typically have a wide size and specific gravity distribution, due to difficulties caused by the rapid settling of coarse and heavy particles. These techniques are based on sedimentation and determination of various rheological parameters such as viscosity, yield stress, and torque values at high shear rate.

**Economic Impact:** This advance has made smelting more energy efficient. Findings have led to the derivation of better pathways for enhancing selective separation of valuable minerals from complex ores containing slimes and development of robust solutions to the long-standing prob-

lems related to slimes. Most importantly, this work has resulted in the design of greener, more sustainable solutions for the mining industry: new processes that consume less water and energy. They use green reagents that significantly reduce the overall environmental footprint of mining. This has made the mining industry more economically productive. It should extend the lifetime of existing mining operations and save jobs and resources.

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## Novel Technologies for Superior and More Sustainable Consumer Products

*This work leads to more effective use of surfactants generally in cleansing product lines and to higher performing products.*

Researchers at the Center for Advanced Studies in Novel Surfactants (CASNS) studied complicated systems that involve interaction among multiple ingredients, including surfactants, polymers, enzymes, solid particles, solvents, and electrolytes in water and with substrates such as skin and fabric materials. They examined novel materials and commercial ingredients in attempts to identify greener, more environmentally friendly cleaning ingredients.

By investigating the physical properties and micro-structures of surfactant systems and their associations with material performance, the researchers were able to advance the science that led to a new generation of less expensive product formulations that continue to have equal or higher performance characteristics and smaller environmental footprints.

This research enabled the development of a newer generation of laundry detergent formulation that had better textile skin feel, greater resistance to pH variation, more robust profiles of stain removal in the laundry washing process, and was more cost effective. It led to more effective use of surfactants generally in cleansing product lines and to higher performing products.

**Economic Impact:** This work is providing opportunities for member companies in their R&D efforts to develop products with higher performance and lower costs and smaller environmental footprints. It is providing a knowledge base and framework of learning for industrial applications in the personal care and household cleaning sectors. Applications of this new knowledge are impacting the production and quality of soaps, shampoos, and other cleaners, thus making them milder, less irritative, and more effective.

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