

IFPRI Project Brief
Wetting of heterogeneous particles

The process of dispersing a powder into a liquid involves many elementary processes with different kinetics that often occur simultaneously, such as wetting, capillary imbibition, dissolution, swelling, particle erosion and fracture, etc. The complex and often non-linear dependence of these processes on material and process variables hinders the development of a fundamental understanding of powder dispersion in liquids.

When adding a powder to a liquid, the first step in dispersing the powder is to move particles through the air-liquid interface by gravitational force. We believe that developing a fundamental and quantitative understanding of this process for *individual* complex particles, e.g. ones with complex shape, internal structure (porosity), and complex surface chemistry, is a good starting point for understanding the larger dispersion problem. This is the primary objective of this IFPRI project.

The project should have both experimental and modeling/computational components. Key to this is the development of *physical* model particles with tunable properties that can be used in experiments to develop and validate models and simulations. Particle agglomerates are in scope, particularly loosely bound ones that can represent the “lumps” of powder that often persist at the air-liquid interface during dispersion preparation. The properties are those that control the rate of transport of particles across the interface, for example:

- a. particle morphology: particle size, shape, roughness, porosity, pore structure
- b. particle surface energy (dispersive and non-dispersive)
- c. interfacial tension of the liquid interface
- d. density ratio
- e. particle mobility in an agglomerate
- f. rate of escape of gas from internal pore space

While the selection of the experimental system is unconstrained, it is important that the results of this project be relevant to dispersions of industrial interest, which typically contain particles that range in size from submicron to millimeters and typically are multicomponent.