



Particle incorporation in liquid – P&G's perspective

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Particle/powder incorporation in P&G



- Majority of all our formulated products involves particle incorporation in liquid
- Powder incorporation is done either manually or automatically, either in a batch or a continuous process
- The percentage of particle in a formulation varies significantly from formulation to formulation
- In addition to dispersion, polymeric particles added for rheology modifying go through hydration and dissolution
- Process development is still done empirically
- Significant challenge to scale lab and pilot plant learnings to production



In the near term, we are interested in

- Measurement, in particular, inline methods for PSD of multiphase species including particle, drops and gas bubbles; species homogeneity, gas volume fraction, particle hydration kinetics, etc.
- Models to guide particle incorporation process optimization and scalability

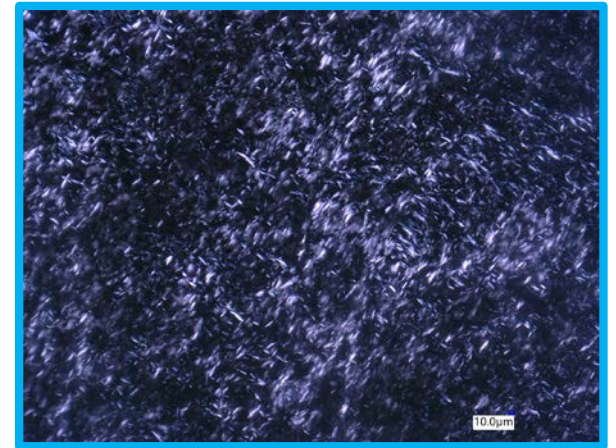
In the longer term

- We would like to be able to design and scale particle incorporation process virtually
 - Select a mixer based on knowledge of particle cluster strength and how it evolves in formulation
 - Determine the operating condition and scalability by modeling the kinetics of particle dispersion

An example



1. In dentifrice, silica is incorporated as abrasive active. Silica also acts as a product rheology builder.
2. The process of Silica incorporation differs. Some plants use a batch process, others an inline high shear mixer.
3. As the silica slurry goes through mixing, attrition to silica particles changes the effective volume fraction of particles, in turn, changing the slurry rheology.
4. Inconsistent shear history to silica can be a source of inconsistent product rheology.
5. It would be highly desired if silica PSD can be measured inline, or silica degradation through a shear history can be accurately modeled.



Silica slurry