



# IFPRI Project Abstract

## **Selection of Flow Aids: Model-based Prediction of Flow Properties Enhancements**

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### ***Project Objective:***

Mechanistic prediction of flow properties and its enhancements from particle scale measures, developing a collection of models and tools that can be used for the type and amount of flow aid selection while minimizing the extent of experiments needed.

### ***Approach:***

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Develop vdW-based particle contact models along with host-guest surface energies for the purpose of selecting the right type and amount of nano flow aids and resulting flow enhancements. Experimentally validate the models on a range of test materials.

### ***Recent Results:***

Continued work on flow enhancements of ~30 powders using two types of silicas processed in a high-intensity device. Used the improved contact model to account for macro-rough surfaces to address the outliers in predicting flowability. Investigated cases where one of the blend components was dry coated to propose guidelines for selecting which component should be coated. This work confirms that the entire powder sample need not be dry coated. Further investigation of 40+ blends revealed a positive synergy for most blends with one dry coated component resulting in the flowability of the mixture of two components being greater than the individual ones. Examined property enhancements for four fine powders individually dry coated with four different silicas. These cases were used to explain the flow enhancement outcomes by integrating all the models; i.e., guest-host suitability, ideal amount of silica, silica aggregation after processing, and a multi-asperity model to compute expected cohesion reduction.

### ***Next Steps:***

Open questions include: While the developed models work well even for many powders that are neither perfectly smooth nor spherical nor have a narrow PSD, would the same models handle for those with more enhanced non-spherical shapes, excessive macro-roughness, and wider PSDs? Industry uses different types of mixing/coating devices that are not high intensity. How to account for uneven flow-aid coating and its agglomeration that may result from such industrial mixers/coaters? How easy would it be for an industry practitioner to incorporate various models and guidelines? How do the learnings based on the results with silicas extend to other type of flow aids? Is coating of flow aids generally robust? Is the coating effectiveness affected by humidity during processing?

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