Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Quantification of Aggregate Topology in Fumed Silica ANDREW MULDERIG, GREGORY BEAUCAGE, KARSTEN VOGTT, HANQIU JIANG, Univ of Cincinnati — Ceramic aggregates are fractal structures consisting of aggregated primary particles and the nanostructure is widely characterized in terms of primary particle size, aggregate size and mass fractal dimension. However, these quantities alone fail to quantitatively describe branching in these materials. Many important properties of fumed silica are derived from its highly ramified aggregate topology. Ultra-small angle X-ray scattering (USAXS) is a powerful technique to characterize fractal structures over a range of length scales. Application of the Unified scattering function across the hierarchical levels allows the topological parameters to be quantified. The parameters determined from USAXS were then compared with TEM micrographs. Aggregates of smaller primary particles showed significantly higher degrees of aggregation and displayed higher branch fractions compared to aggregates of larger primary particles. Topological parameters from scattering were compared with results from simple models and were in good agreement. Quantification of aggregate topology lays the framework for predictive modelling of silica's topological contribution to its valuable reinforcement and rheological properties in commercial applications.

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Date submitted: 10 Nov 2016 Electronic form version 1.4