

Surface modification to investigate charge segregation in single component materials

Keith M. Forward, Daniel J. Lacks, and R. Mohan Sankaran

Case Western Reserve University
10900 Euclid Ave, A.W. Smith 228
Cleveland, Ohio 44106, USA

Abstract:

In single component granular materials, bipolar charging often occurs where small particles charge negatively and large particles charge positively. This charge segregation appears to be independent of material. We have examined several single component systems where this phenomenon occurs; polyethylene resin particle, glass beads, and Mars simulant (JSC-1 Mars simulant). These results may be explained by a population balance model, in which the charge segregation occurs from an asymmetrical transfer of a negative species (i.e. electrons or hydroxide ions) between small and large particles. In an attempt to verify this model, we have modified the surface of glass beads and tubes with an alkylsulfonic acid containing mobile cations (i.e., a negative control charge agent). According to the population balance model, the opposite polarity between small and large particles will occur in this case. The experiments in fact show charge segregation such that small particles tend to charge positively and large particles tend to charge negatively, in reverse of the unmodified surface experiment. In addition, asymmetrical contact between modified glass tubes was examined to further investigate the transfer of positive ions between surfaces.