MULTI-MODAL DENSE SPHERE PACKING ALGORITHM FOR THE SIMULATION OF THERMITES

Christian Günthner, Sebastian Knapp, Volker Weiser

Fraunhofer Institut für Chemische Technologie ICT

76327 Pfinztal, Germany

christian.guenthner@ict.fraunhofer.de

Abstract

This work presents a packing algorithm in two and three dimensions for the simulation of multi-modal dense sphere packing in finite volumes and its application to the Al-CuO-thermite. We employ a variant of the event-driven dense packing algorithm by Lubachevsky [1], which simulates the growth of randomly distributed particles and their Brownian motion inside a finite, non-periodic geometry until a dense packing is reached. We apply this algorithm to study the impact of the particle size ratio on the stoichiometric Al-CuO-mixture. To this end, we simulate multiple two-dimensional dense packings for the same set of parameters and statistically evaluate the filling fraction and particle distances and compare these results to calculations in three dimensions.

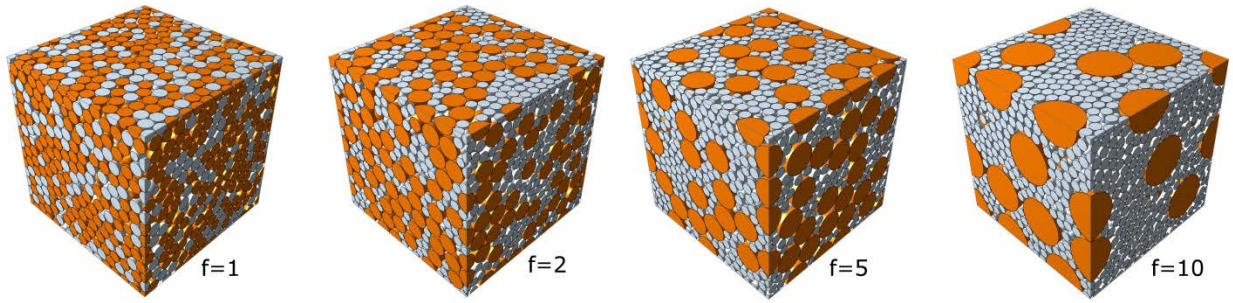

Fig. 1: Visualization of three-dimensional bimodal dense sphere packings of 4000 particles for different Al-CuO-particle size ratios f at the stoichiometric point (c_{Al}=19%-ma, gray: Al, orange: CuO).

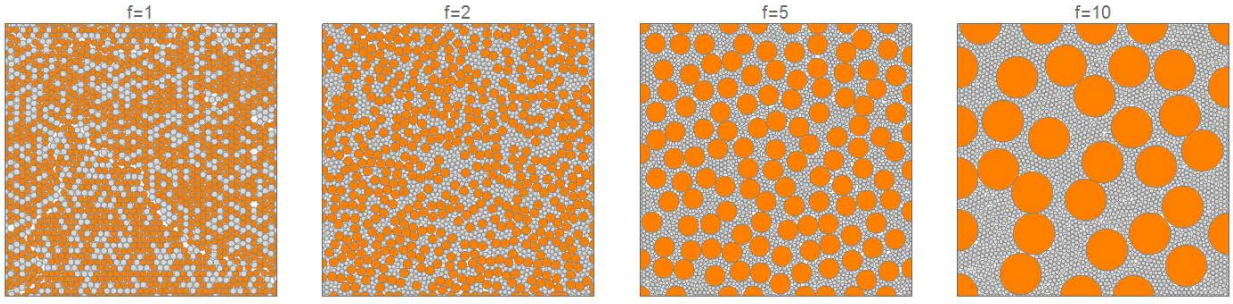

Fig. 2: Visualization of two-dimensional bimodal dense sphere packings of 2000 particles for different Al-CuO-particle size ratios f at the stoichiometric point (c_{Al}=19%-ma, gray: Al, orange: CuO).

References

[1] Lubachevsky, 1990, Journal of Statistical Physics Vol. 60