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Computational models for triboelectric charging in dense mono- and bi-disperse granular flows

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To better understand the complex processes of tribocharging and mitigate associated problems, a Eulerian computational model for general bi-disperse particle distributions has been developed using the Kinetic Theory of Granular Flows [1]. Discrete charging models of Matsusaka [2] and Schein [3] have been used to close the collision integrals. Charge-velocity covariance which contributes to kinetic (self-) diffusion of charge has also been considered, and closures for both collisional and kinetic diffusion of charge have been obtained and included. Monodisperse simulations emulating laboratory experiments in a fluidized bed were carried out to validate the model and it was shown that larger particles have a lower proclivity of sticking to the wall. The order of magnitude of charge in different regions of the fluidized bed was also consistent with the experimental observations. Subsequently, steady-state, one-dimensional bi-disperse simulations without momentum transport were carried out which predicted bipolar charging for particles of different sizes. Recently, the phenomenon of particle sticking has also been further investigated and it was shown how particles of opposite polarity can lead to stable layer formation on the wall surface.

References

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