Advanced lubricant properties of granular materials between sliding interfaces

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In this work, DEM numerical simulations of granular systems sheared between two rough counter-surfaces and under steady, constant-load conditions, have been performed. In the simulations, a collection of identical spheres is sheared between two parallel bumpy walls moving at constant velocity in opposite direction, and the rough walls are made bumpy by gluing particles in a regular array. The main purpose of the research is to investigate the lubricant properties of granular particles in a sliding interface with multiple contact asperities, with the long-term goal of designing realistic transport systems for the industry of particulates with extremely low energy-demand. We focus particularly on high applied loads, relevant for practical applications of granular lubricants, which may lead to crystallization of the granular system with significantly increase in the shear resistance. A systematic investigation of the role played by particle properties, imposed normal load and boundary roughness on the flow dynamics, macroscopic friction and crystallization process has been conducted, to find the best combination of micro and macro parameters to reduce shear resistance.