Numerical Simulation of Dynamic-Liquid-Bridge Mediated Particle Agglomeration

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In many powder handling processes including liquid (e.g., wet-granulation, coating, and drying), the liquid bridge formed between particles is not static and can be easily compressed, deformed, and ruptured, because the particles inside the processes are always moving. Therefore, particle agglomeration by such a "dynamic" liquid bridge should be modeled to understand micro-level particle agglomeration phenomena inside the powder handling processes. In this study, a numerical modeling of the dynamic liquid bridge between two spheres was conducted using a coupling simulation of a discrete element method (DEM) for a particle motion with a constrained interpolation profile (CIP) method for a liquid–gas two-phase flow consisting of a liquid bridge. A break up behavior of a liquid bridge between two spheres was initially simulated, and the simulation result showed good agreement with an experimental result. Agglomeration of two particles mediated by the dynamic liquid bridge was then simulated and key parameters were investigated.

Keywords: Dynamic liquid bridge, Particle adhesion, Discrete element method, Constrained interpolation profile method