The ductile behavior and microstructure of wet agglomerates

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Abstract

By using molecular dynamics simulations in three dimensions, we investigate the effects of material parameters and binding liquid content on the plastic properties and texture of wet agglomerates composed of solid particles under diametrical compression test. The numerical algorithm with a capillary cohesion law in which the cohesion force is an explicit function of the gap between primary particles and liquid- vapor surface tension [1], the binding liquid content is mainly accounted for a debonding distance with the binding liquid assumed to be distributed homogeneously inside wet agglomerates [2, 3]. We present the numerical method and analyze the mechanical strength and evolution of the microstructure during diametrical compression. We find that the wet agglomerate shows the ductile behavior due to the rearrangement of wet primary particles during the compression. The compressive strength of wet agglomerates reaches a plateau before failure due to the irreversible loss of wet contacts between primary particles. The plastic threshold of wet agglomerate is proportional to the cohesive stress which increases with the size span and nearly liner function of rupture distance, the cohesive stress is defined from the ratio between the liquid surface tension and the mean diameter of primary particles.

References

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