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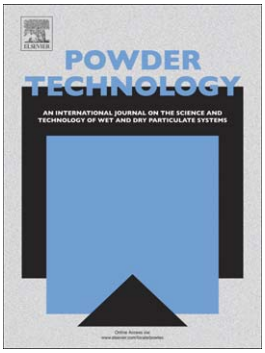

Mechanisms of crack formation in die compacted powders during unloading and ejection: An experimental and modeling comparison between standard straight and tapered dies

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Mechanisms of crack formation in die compacted powders during unloading and ejection: An experimental and modeling comparison between standard straight and tapered dies

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Abstract

In an effort to identify the origin and the evolution of damage during the compaction/ejection cycle of powder compacts, an experimental study that compares compacts in straight and tapered dies in terms of the presence and growth of microcracks was carried out using x-ray tomography and environmental scanning electron microscopy. The results presented here document the presence of internal microcracks at high relative densities, and microcracks on the surface of the compacts. Parts compacted in tapered dies exhibit microcracks with smaller crack tip opening and have a higher axial strength than those made in a straight die. These experimental observations, together with the ideas of damage generation under compressive stresses, as well as finite element analysis of the stress field in the compact as it exits from the die, confirm the hypothesis that a two-step mechanism is responsible for damage generation in powder compacts. First, microcracking occurs during unloading within the die at high pressures and subsequently surface cracks grow under the localized stresses as the compact emerges from the die.

Keywords: powder compaction; microcracking; mechanical properties; Drucker-Prager/Cap

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