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Yield Parameters for Iron Powder Compaction on Different Particle Size and Amount of Interparticle Lubricant

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Abstract

Powder metallurgy, PM method is well known one suitable method to produce metal parts with high accuracy and high cost performance as it can process complex shape. However, in metal powder compaction process using closed-die system, shear failure of green compact such as slip-crack often occurs especially for compaction of multi-step part. It is considered that the slip-crack appears as shear plane on boundary of high density region and low density region. Since it is important to predict such failure behavior during compaction process, forming analysis using finite element method, FEM should be applied for design of die compaction process. Thereby, it is necessary to identify yield criteria of various metal powder as continuum materials. Since Drucker-Prager Cap (DPC) model which is a kind of built-in yield criterion for granular materials consists of shear failure yield surface and cap yield surface, it is useful for prediction of shear failure occurrence of green compact. Yield parameters of DPC model have been successfully estimated for atomized iron powder using several material testing methods, which are simple compression test, single shear test and lateral force measurement test in previous work. However, stress state during compaction process is varied by amount of interparticle lubricant and mean particle size. This study provides materials parameters for iron powder in DPC model on different particle size and several amount of interparticle lubricant. Yield surfaces of 0.2, 0.5 and 1.0 mass % zinc stearate addition and particle size of 100 μm and 10 μm have been estimated. Results are as follows; (1) Coefficient of shear failure line decreases with decreasing amount of lubricant. (2) Cohesion decreases with increasing amount of lubricant. (3) Both parameters become higher with 10μm particle size.

***Keywords**:* Powder metallurgy, Metal powder compaction, Iron powder, Drucker-Prager Cap model, Finite element method