

應用有限元素法於多孔質金屬輥軋加工之研究

陳狄成

摘要

本研究是應用有限元素 DEFORMTM-2D 軟體，分析輥軋加工時多孔質金屬板材於輥隙內之變形型態。研究的內容針對多孔質金屬板內含空孔與介在物於輥軋中變形情形，例如分析空孔與介在物之密度分佈、閉合行為、變形機制和應力應變分佈等，探討板厚壓下率、內孔尺寸大小、摩擦因子、密度大小和輥徑大小等輥軋條件對金屬板密度分佈、內孔閉合度與介在物發生前後空孔之影響。並且討論多孔質金屬內含缺陷空孔之完全閉合的臨界輥軋條件，及影響介在物前後空孔閉合臨界壓下率的因素，再者以實驗來驗證，模擬結果希望能提供多孔質金屬輥軋加工之參考。

關鍵字：有限元素；多孔質金屬輥軋；空孔；介在物

Study on Rolling Processes of Porous Metals Using the Finite Element Method

陳狄成

Abstract

Using a finite element DEFORMTM-2D software, this study simulated plastic deformation of the porous metal sheet at the roll-gap during sheet rolling processes. This study consists of a few parts for internal void and inclusion inside the porous metal sheet during sheet rolling. Relative density distributions, closing behavior, the deformation mechanism and stress-strain distributions around internal void and inclusion inside the porous metal sheet during sheet rolling were discussed numerically. The influences of various rolling conditions, such as the thickness reduction, the dimension of the internal void, friction factor, density amounts, roll radius, etc., on the dimension of the voids at the exit were discussed. The critical rolling conditions, over which the defective void and front and rear vacancy of inclusion would close completely, were also investigated. Theoretical predictions of the dimension of void after rolling were compared with experimental results. The simulated results can provide useful knowledge for designing the pass schedule of porous metals rolling processes.

Key words: Finite element;Porous metals rolling;Void;Inclusion