Accepted Manuscript

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PII:	S0924-0136(18)30138-9
DOI:	https://doi.org/doi:10.1016/j.jmatprotec.2018.04.003
Reference:	PROTEC 15703

To appear in: *Journal of Materials Processing Technology*

Received date:	1-3-2018
Accepted date:	3-4-2018

Please cite this article as: Long ZHANG, Huang YUAN, A Quantitative Description of Machining Effects to Mechanical Behavior of Sintered Powder Metals, *<![CDATA[Journal of Materials Processing Tech.]]>* (2018), https://doi.org/10.1016/j.jmatprotec.2018.04.003

A Quantitative Description of Machining Effects to Mechanical Behavior of Sintered Powder Metals

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Abstract

Sintered powder metals play increasingly important role in industry. The most remarkable mechanical characteristics of the sintered material is the high porosity, which characterizes deformations and failure of the material. It is confirmed additionally that manufacturing process affects mechanical behavior and fatigue performance of the material. In the present work a continuum damage mechanics model is used to describe the damage evolution in machined sintered iron. It is confirmed that machining effects are localized in the sub-surface layer of the mechanical part, and the damage can be quantitatively described by the damage model. The experimental results from the fabricated specimen have to be separated into mechanical behavior of the sub-surface layer and the specimen core. The damage model provides an effective way to describe mechanical performance of a machined part of the sintered iron.

Keywords: Sintered porous iron, machining effects, micro-cracks, multi-axial loading, continuum damage modeling

1. Introduction

Reihanian et al. (2011) claimed sintered powder metallurgy is a special technology with advantages in zero waste, accurate dimension and artificial alloy components for near-net shape manufacturing of complex structures. With improvement of powder metallurgy more components made of sintered alloys are applied under complex and high loading conditions. Mower (2014) and Salak et al. (2005) presented that for certain applications the sintered parts may need further machining, such as drilling, milling etc. Due to the highly porous microstructure of the sintered powder metals the macroscopic mechanical property depends on local void morphology and distribution. Machining can affect material property significantly.

Rausch et al. (2010) has mentioned that the microstructure of the sintered metal is characterized by connecting voids and connecting alloy particles, which is the most obvious

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