A Debinding Method Using Supercritical CO_2 on MIM Process

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ABSTRACT

MIM is an important method in the metal forming technology. Though, this process is incomplete, and still has problems in each processing step. Especially in the debinding step, there are many problems. In an actual producing process, the thermal debinding method is still used, and this method needs long debinding time. Also, the size of products is limited, and the metal powder is oxidized in this method. As a method to overcome these problems, the solvent debinding process is used recently. This method is an efficient debinding method. Though organic solvents are used in this method, they are poisonous. These solvents will harm human health and environment. For this reason, a debinding method which uses super critical dioxide(CO_2) is desirable. Using this method, quick debinding is possible, and a thick green body can be debinded. Moreover, the solvent used in this method is safe and harmless for environment.

INTRODUCTION

MIM process still has many problems especially in the debinding step. In an actual producing process, the thermal debinding method is still used though this method needs long debinding time. Also, the size of products is limited, and the metal powder is oxidized in this method. As a method to overcome these problems, a extracting method which uses supercritical dioxide(CO_2) was described.[1,2]. This method is used in food or chemical industry extensively to extract organic ingredients. Also, this method is applied to liquid chromatography for analyzing organic components. Recently, an application of this method to the extraction of binder from ceramic compound was described[3,4], and extraction rate by supercritical CO_2 was discussed[5]. In this study, this extracting method is applied to the debinding step of MIM process, and products using this method are evaluated.

CHARACTER OF SUPERCRITICAL FLUID

Supercritical Fluid is a physical state over the critical temperature and the critical pressure and it is assumed the state between liquid and gas. In Table 1, typical physical parameters of liquid, supercritical fluid, and gas are compared. From this table, supercritical fluid has density and diffusion coefficient like liquid and viscosity like gas. It means that the supercritical fluid can go into porous body like gas, and