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Preparation of Aluminum feedstock for green part specimen using metal injection molding

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Abstract. In metal injection molding, to identify the homogenous aluminum based feedstock is a challenging issues. In this study, a metal injection molding of aluminum feedstock which contains of high density polyethylene, stearic acid and paraffin wax as binder system was performed. The feedstock are used to produce tensile and gear shape green specimens using injection molding machine. The process ability of the metal injection molding feedstock depends on different parameters such as their binder composition and amount of metal powder used. From this study, the percentage of volume shrinkage experienced a sudden increase at the metal composition more than 50%. It also shown that, the paraffin wax content, affects the feedstock performances.

Introduction

Metal injection molding (MIM) is at near-net shape process which is used for fabrication of complex and uniform metallic products. It combines the plastic injection molding technology and the advance of powder metallurgy technique with various choices of material [1].

In general, the processing steps involved in MIM are: mixing, injection molding, debinding and sintering. Within mixing process, the binder will be combined with the powder material to make a mixture referred as the feedstock. The feedstock will be prepared directly into suited sizing with regard to injection molding. During injection molding, the feedstock will be shaped into the required shapes and sizes simply by the effective use of high temperature as well as force. After solidification, the molded green parts will be ejected out from mold cavity. Next process is debinding, the place that the binder will be taken out slowly from green parts. After debinding, the part will be sintered to offer the required components [2,3].

It is a combination of small quantity of binder and metal powder to form homogenous feedstock that can be injected into mold. The role of the binder is to hold the metal particle and serve as backbone to maintains the shape during the injection until the sintering process. The best feedstock should have less viscosity at the injection stage and rapid viscosity change during solidification.

The actual particle size with the precious metal powder will limits the producible molded sizes. Therefore, feedstock of substantial strength along with smaller sized powder are usually suitable. Thinking about the smaller sizes and also the substantial aspect ratio, the binder system should be suitably selected as a way to allow higher green strength with regard to demoulding, reduced viscosity with regard to easy filling of mold cavity in the course of injection molding, and also good shape preservation and reduced shrinkage in the course of debinding and sintering [4,5].

Currently, stainless steel feedstock is readily in the market due to high demand on this material for metal injection molding but not for aluminum based feedstock. Thefore, this paper will present the experimental investigation on best combination of aluminum powder with binder as feedstock for producing a green molded parts.