# STUDY OF PORE STRUCTURE EVOLUTION DURING DEBINDING PROCESS

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## ABSTRACT

Metal Injection Molding (MIM) is an advanced metallurgical technology that integrates the shape-making capability of plastic injection molding with the material flexibility of powder metallurgy. The uniqueness of MIM has enhanced the ability to manufacture high integrity metal parts in complex shapes of precise dimensions. The cost also effective for mass production compared with other production methods. This process consists of several steps that are mixing to produce a homogeneous feedstock, injection molding, debinding and sintering. Each step plays a vital role in order to achieve high quality final product. Study of pore structure evolution during debinding process is important especially to produce good dimensional accuracy and defect free product. Some debinding parameters such as initial temperature, maximum temperature and heating rate influences the pore structure evolution in debinded part. In this study, the mold injected feedstock or green body which consists of carbonyl iron powder having a mean particle size of 4 μm and spherical shape and ready made known as Hostamont EK583 were used. Two-stages debinding process and some debinding parameters as mentioned above were applied during the investigation. The scanning electron micrograph was used in order to clearly monitor the morphologies of the fractured surface of debound parts. Results shows that the pore structure start to develop from the surface of the fractured surface during solvent debinding process. The wider pore structure developed during thermal debinding process and this time most of the binder content had completely removed. In addition, during thermal debinding process, the binder removal occurred in three phenomena and these phenomena had been found during TGA analysis. These phenomena strongly influence the pore structure evolution and finally the final dimension of product. The heating rate during thermal debinding process also influences the pore structure evolution and the best heating rate found is 0.3 °C / min. The heating rate provided the best surface finish and the pore produced also more uniform.

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# CHAPTER I

# INTRODUCTION

## 1.0 Introduction

Nowadays, the market situation becomes more competitive and it is important to find the production method to enhance the ability to manufacture metal product with high shape complexity with high production quantity and low cost. An approach to meet such challenges has been the development of Powder Injection Molding (MIM). MIM uses the shaping advantage of injection molding but is applicable to metals and ceramics.

The first studies about PIM (powder injection molding) are made in the USA and dates back to the 1920s, as they refer specially to CIM (ceramic injection molding). Afterwards, during Second World War, the results of these studies are applied to metal powders (Fe-Ni) and the first metal injection molded parts are manufactured.

Metal Injection Molding (MIM) is an advanced metallurgical technology that integrates the shape-making capability of plastic injection molding with the material flexibility of powder metallurgy. The uniqueness of MIM has enhanced the ability to manufacture high integrity metal parts in complex shapes of precise dimensions. The cost also effective for mass production compared with other production methods.

From the economic point of view, machining is a competitive technology only when the part is not geometrically complex. If the parts become more complex, forgings, die-castings and especially die-pressed the parts will be more economic. However, these