A COMPARISON OF METHODS OF REACHING HIGH GREEN DENSITIES USING ELEVATED TEMPERATURES

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ABSTRACT

It is well known that the properties of powder metal components increase as the density increases. There are many methods of increasing the density of green compacts, including lubricants, warm compaction, and increased compaction pressures. The purpose of this paper will be to describe the properties achievable using elevated die and/or powder temperature to achieve increased green densities. Green densities achieved using elevated temperature processing will be compared to green.

INTRODUCTION

The ability to efficiently achieve high green densities in powder metal (PM) components has been the subject of much research. Reaching high green densities allows higher sintered densities, and subsequently higher material properties. The ability to reach high material properties allows the potential for applications such as high performance gears in automotive, lawn and garden, and hand tool applications. As the performance level is increased, the potential for sales of PM components is also increased[1].

In the field of powder metallurgy, there are many methods of achieving high green densities. These methods include high velocity compaction [2], warm compaction [3], reduced and advanced lubricants [4,5,6], and high compressibility powders [6]. Each of these methods has many advantages and disadvantages associated with it. The purpose of this paper will be to discuss conventional and warm compaction, and introduce elevated die temperature compaction.

Conventional compaction can be used to reach high densities by using elevated compaction pressures (>700MPa (50tsi)), high compressibility powders, or reducing lubricant level [3,4,5,6]. High compaction pressures have theoretical limits when considering part configuration and tooling requirements. The highest compressibility powders are typically pure iron, which is not always suitable for the very high performance applications where increased densities are required [6]. Finally, reducing the lubricant level