A COMPARISON OF INDUSTRIAL PROCESSING STRATEGIES UTILIZED TO CONSOLIDATE ALUMINUM POWDER METALLURGY ALLOYS WITH AEROSPACE RELEVANT CHEMISTRIES

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ABSTRACT

The application of low density materials is prominent within the transportation industry owing to a universal desire to reduce system weight and thereby improve fuel economy. This is largely underpinned by increasingly stringent environmental regulations and economic considerations in manufacturing. The powder metallurgy (PM)-based fabrication of engineered components from aluminum alloys capitalizes on this scenario and has recently grown in both popularity and commercial stature within the automotive field. Given the advances realized, it is possible that opportunities may exist in other segments of the transportation industry as well – most notably, the aerospace sector. As a precursory step in this direction aluminum PM alloys with aerospace relevant chemistries have been processed through an array of the most modern PM technologies available. These included die press/sinter, CIP/sinter, sinter/HIP, sinter/forge, and spark plasma sintering. Data on the corresponding microstructures, tensile properties, and residual impurities indicates that select PM materials are competitive with traditional wrought systems and may hold long term promise for aerospace inception.

1.0 INTRODUCTION

The concept of aluminum PM was first developed by researchers at ALCOA in the late 1960's at which time PM equivalents to the wrought alloys AA2014 (PM-AC2014) and AA6061 (PM-A6061) were pioneered [1]. These so-called "press and sinter" alloys were produced from mixtures of elemental/master alloy powders, exhibited a reasonable response to PM processing and represented a promising means of fabricating automotive components in an economical manner. However, commercial applications in the years that followed were limited at best. Interest in economical "press and sinter" technology was eventually renewed in the 1990's when camshaft bearing caps were first produced for