A CORRELATION OF MECHANICAL PROPERTIES OF SINTERED U-700 POWDER WITH PARTICLE BOUNDARY MORPHOLOGY

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INTRODUCTION

Difficulties in forging cast superalloys have caused the Air Force and engine manufacturers to concentrate their efforts to develop a powder metallurgy preform which would be suitable for forging.[1-7] As superalloys have developed, large concentrations of alloying additions have been made to improve high temperature properties. These increased additions have promoted segregation within the cast alloy. This segregation has narrowed the forging temperature range and resulted in alloys which are difficult to forge. Since a powder particle is an extremely small casting, segregation is restricted to each particle of powder. The fine particles with their microsegregation then facilitate complete homogenization of solubles. This in turn provides a more efficient utilization of alloying elements and implies that the optimum alloy composition for superalloy powders may be different than present alloys which are now fabricated by the cast/forge process. Similarly, it might be suspected that heat treatment response could be different for a powder compact because of the homogeneity of the powder and the increased degree of supersaturation.

Although superalloy powder compacts offer attractive advantages for forging, powder consolidation is still not free of problems. Unlike a solid ingot where the surface area is relatively low, the surface area of powder compacts is high. The abundant surface area renders the powdered alloys prone to oxidation; hence the oxide content of powder compacts is higher by several orders of magnitude than the oxide content of vacuum cast ingot. The influence of oxygen upon mechanical properties is still a matter of controversy, although most