A Compactable Grade of Nickel Aluminide Powder

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Abstract

Powder metallurgy is a viable processing route for the fabrication of nickel aluminide intermetallic materials. However, development of cost-effective processes, such as pressing and sintering, hot pressing, and cold isostatic pressing, have been limited because intermetallic powders produced by gas atomization are typically too hard and brittle to be consolidated. Extrusion and hot isostatic pressing have been the typical methods for consolidating these powders. A novel method for forming nickel aluminide intermetallic powders based on reaction synthesis has been developed and used in these studies. These powders possess good compressibility and may be compacted to high green densities and also possess high green strength prior to sintering. Results on the compaction and sintering of these new nickel aluminide powders are presented here to provide a basis for assessing mechanical property combinations. Tensile properties include hardnesses in the range from 90 to 100 HRB, yield strength of 350 MPa, tensile strength of 800 to 900 MPa, and fracture elongation of approximately 17%. Applications dependent on this processing knowledge are discussed.

Introduction

Intermetallic compounds have similarities to ceramics, as both ceramics and intermetallics are stoichiometric, with limited compositional ranges and brittle behavior. Many of the intermetallics have a high melt viscosity that inhibits casting; cast intermetallics also suffer problems with grain size control and segregation. Hence, the limited ductility forces a reliance on powder techniques for shaping and consolidation. The high melting temperatures make intermetallic compounds attractive for high temperatures service, but contributes to