GRAIN REFINEMENT IN TiC-Ni_3Al COMPOSITES

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Composites of TiC-Ni_3Al are under development for application in diesel engines because of their combination of mechanical properties, physical characteristics and corrosion resistance. Materials of interest contain 30-50 vol. % of Ni_3Al alloy as a binder phase. Grain refinement is important for improved wear resistance and high strength for the applications of interest. Three approaches were taken to change the final TiC grain size. Attrition milling effectively reduces the initial particle size and leads to a reduction of the final grain size. However, an increase in the oxygen content occurs concomitantly with the grinding operation. and decreased densification of the compacts occurs during sintering. Methods to minimize the effects of the oxygen pickup include use of surfactants during milling to prevent surface oxidation and carbon additions to remove oxides in the sintering procedure. Another method for minimizing grain growth is the use of alloying additives. It was found that Mo, Mo_2C and TiN are effective grain growth inhibitors. Finally, rapid sintering was examined as a method to limit grain growth. High densities could be achieved through the use of both belt and pusher furnaces where the samples could be heated under high thermal gradients.

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