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Bulk Nanostructured Ti-45Al-8Nb Alloy Fabricated by Cryomilling and Spark Plasma Sintering

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Abstract

Elemental powder metallurgy is an effective way to improve the ductility and strength of nanostructured TiAl alloys. However, the high ductility of Al largely restricts the application of elemental powder metallurgy. Here we demonstrate a novel avenue in fabricating nanostructured Ti-45Al-8Nb alloys by cryomilling (CM) and Spark Plasma Sintering (SPS) from elemental powder metallurgy. Our work reveals that CM not only prevents the Ti/Al/Nb powder mixture from cold welding, but also makes the resultant powder homogeneous with an average particle size of 217 nm. The nano-powders were sintered by SPS at 900, 1000 and 1100 □, forming ultrafine grained (UFG) equiaxed near-γand lamellar structures. Particularly, as a result of grain refinement strengthening, the specimen sintered at 1000 □ shows excellent mechanical properties, with the compression yield strength, fracture strength and plastic strain as 1575 MPa, 2627 MPa and 23.5%, respectively at room temperature; and 955 MPa, 1041MPa and 38.4% , respectively at 850 □. This work demonstrates the superiority of the combined CM-SPS in fabricating nanostructured Ti-45Al-8Nb