

The Preparation, Structure and Properties of Ni₃Al and NiAl of Light Powder Alloys for Aerospace

K. Povarova and O. Skachkov

Abstract

New light super-heat-resistant powder Ni₃Al- and NiAl-based alloys (the Ni-Al-Mo-B, Ni-Al-Fe-La, and Ni-Al-Al₂O₃ systems), as well as a new technology for their preparation and working, have been developed. The density of the alloys is 7.3-7.5 and ~6 g/cm³, respectively. Ni₃Al sheets were used to prepare, by room-temperature deformation, shields for combustion chambers in gas-turbine engines; the shields operate at 1100-1200°C and shortly at 1300°C. Extruded rods were used to prepare fuel burners for thermoelectric power stations. Activated NiAl powders alloyed with Fe+La were used to produce sintered awkward-shape articles, such as combustion stabilizers in a jet unit of combustion chamber of gas-turbine installation, heat sources, etc. able to operate at $t \leq 1500^\circ\text{C}$ in temperature-loaded articles subjected to slight mechanical stresses. At 1100, 1300, and 1500°C, the 100-h strength of the heat-resistant NiAl-(2-7.5) vol. % Al₂O₃ alloys subjected to directional recrystallization is 70, 35 and ≥ 10 MPa, respectively. Vanes made of these alloys, in which the length of recrystallized grains is less than the vane length by a factor of 1.5-2, were manufactured.