

Mechanical Properties of Al-20wt.% Si Composite Prepared by Hot Extrusion

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Abstract

High temperature tensile and compressive properties of the extruded Al-20mass% Si alloys were investigated to obtain fundamental data for the optimal plastic deformation. Two kinds of alloys including small amount of Cu, Fe, Mg, Mn were produced by the gas atomization process and hot extrusion at 500°C was simply applied to the compacted powders without sintering to pursue industrial advantages. The maximum stresses in stress-strain curves of tensile tests at 500°C increased with increasing strain rate. The highest strain rate sensitivity exponents (m-values) for tensile tests at 500°C were about 0.3 between strain rates of 10^{-2} and 10^{-1} s^{-1} . The fracture surfaces of test pieces showed very fine microstructure and the average grain size was about 1 μm . Real elongations, however, were not high (about 30%), though these alloys have fine-grained microstructure and high m-value. The reason will be that uniform deformation was interrupted by voids included in the materials. The highest m-values for compression tests at 500°C were also about 0.3 between strain rates of 10^{-3} and 10^{-2} s^{-1} . This strain rate region was smaller than that in tensile tests. This difference may be attributed to the hydrostatic pressure in compression tests.