Abstract:

Mechanical properties of aluminium alloys highly depend on their phase composition and microstructure. High strength can be achieved among others by introduction of a high volume fraction of fine, homogeneously distributed second phase particles and by a refinement of the grain size. Powder metallurgy allows to prepare fine grained materials with increased solid solubility which are favourable precursors for further precipitation strengthening. Gas atomization was used for the preparation of powders of the commercial Al7075 alloy and its modification containing 1 wt% Zr. A part of gas atomized powders was mechanically milled at different conditions. Mechanical milling reduced the grain size down to the nano-size range and the corresponding microhardness exceeded the value of 300 HV. Powders were consolidated by the spark plasma sintering method to nearly fully dense compacts. Due to a short time and relatively low temperature of sintering the favourable microstructure can be preserved in the bulk material. The grain size of compacts prepared from milled powder was retained in the submicrocrystalline range and the microhardness close to 200 HV exceeded that of the specially heat treated ingot metallurgical counterparts. The prepared compacts retained their fine grained structure and high microhardness during their exposition to the temperature of 425 °C.