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Enhancement of Hardness Related Properties of Grey Cast Iron Powder Reinforced AA7075 Metal Matrix Composites Through T6 and T8 Heat Treatments

Authors : S. S. Sharma, P. R. Prabhu, K. Jagannath, Achutha Kini U., Gowri Shankar M. C.

Abstract : In present global scenario, aluminum alloys are coining the attention of many innovators as competing structural materials for automotive and space applications. Comparing to other challenging alloys, especially, 7xxx series aluminum alloys have been studied seriously because of their benefits such as moderate strength; better deforming characteristics, excellent chemical decay resistance, and affordable cost. 7075 Al-alloys have been used in the transportation industry for the fabrication of several types of automobile parts, such as wheel covers, panels and structures. It is expected that substitution of such aluminum alloys for steels will result in great improvements in energy economy, durability and recyclability. However, it is necessary to improve the strength and the formability levels at low temperatures in aluminium alloys for still better applications. Aluminum–Zinc–Magnesium with or without other wetting agent denoted as 7XXX series alloys are medium strength heat treatable alloys. Cu, Mn and Si are the other solute elements which contribute for the improvement in mechanical properties achievable by selecting and tailoring the suitable heat treatment process. On subjecting to suitable treatments like age hardening or cold deformation assisted heat treatments, known as low temperature thermomechanical treatments (LTMT) the challenging properties might be incorporated. T6 is the age hardening or precipitation hardening process with artificial aging cycle whereas T8 comprises of LTMT treatment aged artificially with X% cold deformation. When the cold deformation is provided after solution treatment, there is increase in hardness related properties such as wear resistance, yield and ultimate strength, toughness with the expense of ductility. During precipitation hardening both hardness and strength of the samples are increasing. Decreasing peak hardness value with increasing aging temperature is the well-known behavior of age hardenable alloys. The peak hardness value is further increasing when room temperature deformation is positively supported with age hardening known as thermomechanical treatment. Considering these aspects, it is intended to perform heat treatment and evaluate hardness, tensile strength, wear resistance and distribution pattern of reinforcement in the matrix. 2 to 2.5 and 3 to 3.5 times increase in hardness is reported in age hardening and LTMT treatments respectively as compared to as-cast composite. There was better distribution of reinforcements in the matrix, nearly two fold increase in strength levels and upto 5 times increase in wear resistance are also observed in the present study.

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