Effect of SiO_2 on the Mechanical Properties of (Al-Cu-Mg) Alloy

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Abstract:

In present work a prepared specimens of fabricated casting bars with length of each (95mm) length and (12 mm) diameter of composite materials with metal origin represented by (Al-Cu-Mg) alloy reinforced by (SiO_2) particles ,such alloy used in different civilian and militaries industrials fields, according to good mechanical properties , high wear, and corrosion resistance .The particles of (SiO_2)was chosen with weight percentage (1, 2,3 %) .The base cast and composite materials were prepared by casting using Vortex Technique in order to fix up (SiO_2) particles in Homogeneous way on the base cast.

Tensile strength, ductility, hardness, and microscopic of the composite were carried out. The result showed the effect of particle size percentage of (SiO_2) ,any increasing in its percentage cause an increasing of tensile strength ,lower in ductility of the composite , higher in hardness, and particles homogeneously distribution compared with the base (Al-Cu-Mg) matrix .

1-Introduction:

Aluminum and its alloys faced during used many problems due to the low resistance of alloys (change the mechanical properties) when exposed to conditions of high workloads, and one of these alloy ingot current search type Duralumin 2024 consisting of (Al-4.5% Cu - 1.5% Mg), has been selected to contain the aluminum element which is one of the larger non-ferrous metals used to being second only to steel consumption in the world and produces aluminum both types pure and foundry.[1]

The (Al-Cu-Mg) alloy is considered one of the important Al-alloy due to gaining after thermal treatment a high mechanical properties as a result of their ability to precipitation hardening, prompting this recently many researchers in this area to intensify their research efforts on the possibility of the use of aluminum alloys in the manufacture of (Composite Materials) based on aluminum reinforced with ceramic particles to improve the mechanical properties ,like hardening by aging of this alloy.[2]

Hence there is a lot of studies have been operating for the last quarter of the last century to the present day making several amendments to the methods of manufacture of the composite materials (Metal-Matrix Composite), using powder technology , method of nomination (Infiltration) in addition to the use of forms and different types of reinforcement materials for composite materials bear the operating conditions at high temperatures and friction [3].

Tended research also study the effect of the elements foundries added for the purpose of amendment and improvement of materials properties of composite with the base metal.

The aim of this research is to hardening (Al-Cu-Mg) alloy by more than one mechanism and a study of some mechanical properties like resistance to tensile, ductility and hardness by adding (SiO_2) particles to the molten base alloy and study the effect of the following on the mechanical properties:

1- Percentage of the weighted fraction of the (SiO_2) particles added to the base alloy.
2- Grain size for (SiO_2) particles.
3- Cold forming.
4- The nature of the heat treatment conducted on the samples.

In order to study the phases formed at different stages of manufacturing the study included microscopic examination of structure of the base alloy and composite materials before and after thermal treatment.

2-ResearchBackground:

The technology of composite materials developed extensively to include all fields of industry, whether civil or military, following a comprehensive survey of the most important things were received from researches in this field:

In (1982) the researchers (Banerji & Rohatgi) [4] studied the effect of preheating of the ceramic particles in the temperature range between (500 -700) and then add it to the hot molten aluminum, it was found that preheating leads to increase the proportion of granules ceramic retained by the molten and thus the possibility of dispersal, it has been used multiple types of ceramic particles by a group of researchers, these granules are: