Evaluation of the electrical properties in aluminum alloys with the addition of metal oxides

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Abstract

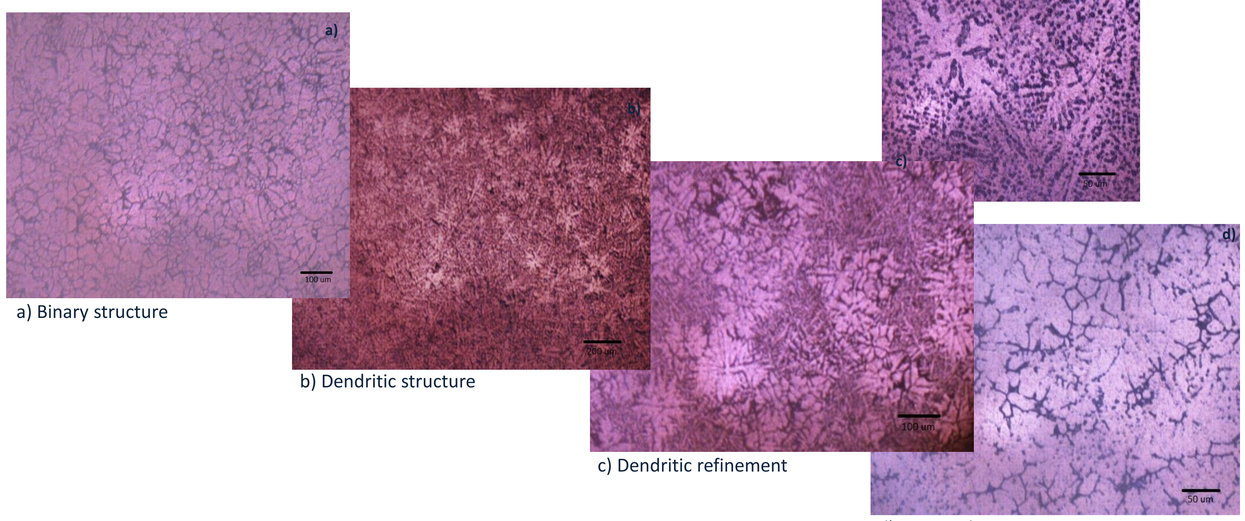
The aluminum based alloys, have characteristics unic that are currently needed mostly in structural applications such as aeronautics, military and transportation [1-4]. Metal oxides addition in aluminum matrix offers the possibility of improving reinforcement in their properties for specific requirements. This work focuses on metal oxides addition effect (ZrO_2 and CuO_2) on the electrical properties of aluminum matrix.

Method

In the alloy synthesis, samples were obtained by stir casting process, by adding 0.15, 0.25 and 0.50 g of metal oxides to 50g of high purity aluminum (99.98%).

Results

Microstructural Characterization



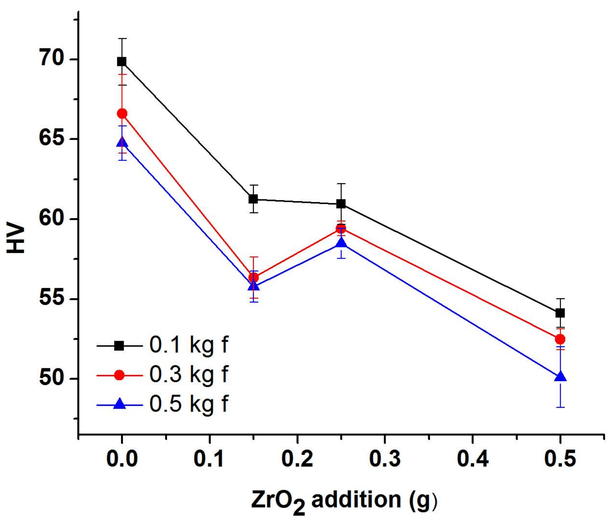
a) Binary structure

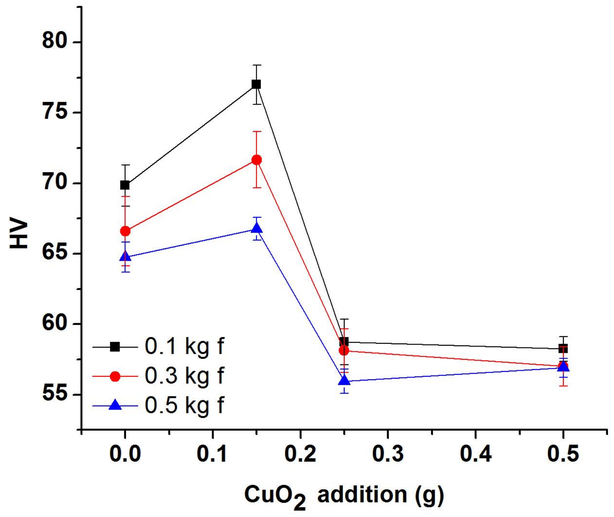
b) Dendritic structure

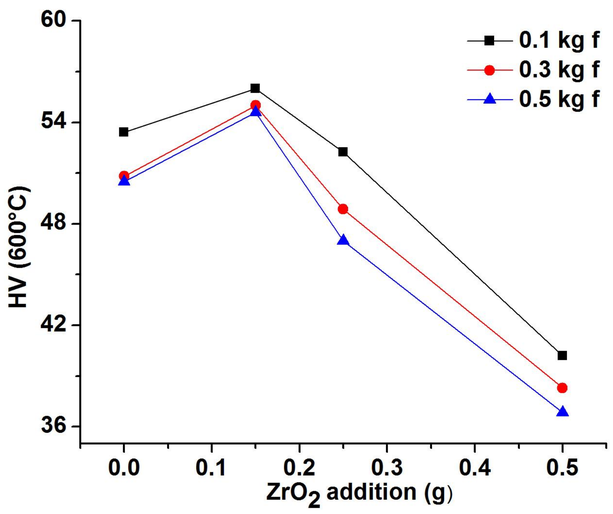
c) Dendritic refinement

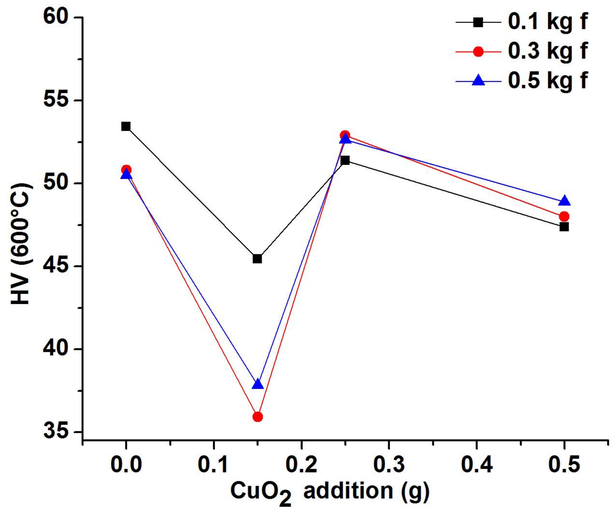
d) Equiaxed grains

Mechanical properties

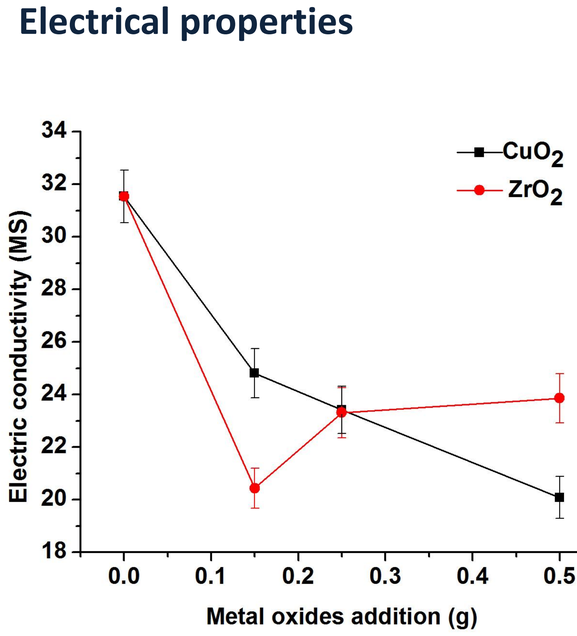




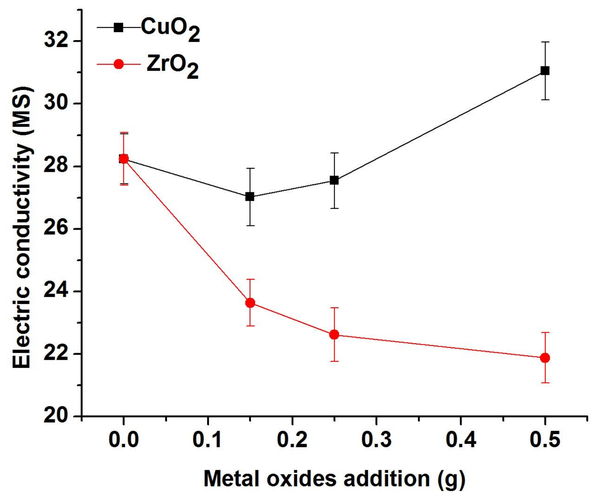


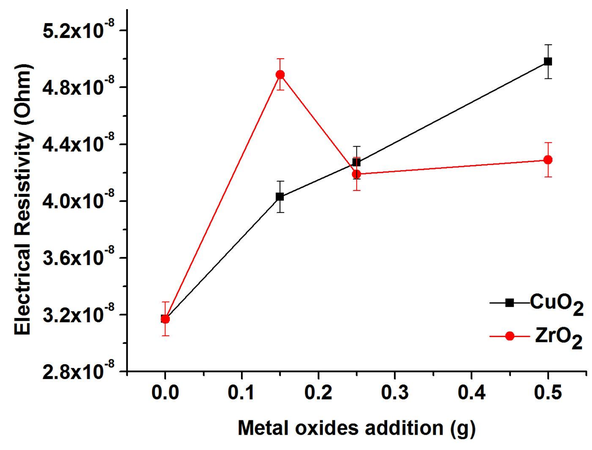


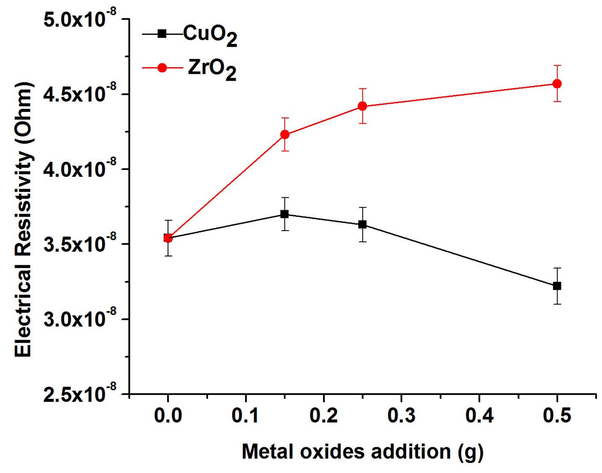
Electrical properties



After annealing (600°C)







Conclusions

The materials hardness decreases with addition of reinforcing particles, producing an increase in the plastic deformation.

Addition of metal oxides particles decreases the conductivity, but after a thermal ageing results in a thickening of precipitates due to diffusion and consequently the precipitate coarsening occurs at the expense of neighbor precipitates leading to the wide spacing between them, these two factors contribute to the rise of electrical conductivity.

The studies showed that the hardness and the electrical conductivity could predict the variation in mechanical properties of Al alloys.

References

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