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Evaluation on hardness and percentage of elongation discrepancy by Zinc oxide nanoparticles on AA6070 alloy composites

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Abstract

The nano particles are the most important materials to develop the mechanical properties of the materials due to its grin structure and size. In this investigation deals with the (20–30nm) Zinc oxide (ZnO) nanoparticles volume participation effect on the AA6070 aluminium alloy composite based on the major mechanical properties like hardness and percentage of elongation. The hardened aluminium alloy is used here due to the better results. The composites were prepared by the stir casting method. The ZnO nanoparticle is increased from zero to 12.5% of volume with 2.5% incremental in each specimen and remaining volume percentage is occupied by hardened AA6070 Aluminium alloy. Among all the specimens 7.5% of ZnO nanoparticle mixed composite have maximum hardness and less percentage of elongation.

Introduction

Improvement of the Characteristics of the materials based on the application is desirable one [1], [2], [3], [4]. There are different methods were utilized to obtain the enhanced results in the different menials by creating the combination of the various materials in different compositions [5], [6], [7], [8], [9]. Among the various method nanoparticle-based property enhancement is one of the most

important methods. Aluminium is most preferable material in the weight reduction process in various parts in any structure.

Hardness of the material should be act as resistance for plastic deformation [10], [11], [12], [13], [14], [15], [16]. There are mainly two hardness measuring methods were frequently used in the materials such as Rockwell and Brinell. In this investigation Brinell Hardness Number (HBN) is considered for the comparisons because the composites were contain maximum aluminium alloy [17], [18], [19], [20], [21], [22], [23], [24], [25], [26]. Then the Percentage of elongation (PE) is the ratio of the difference between final and initial length of the gauge to the initial length in terms of percentage. These properties were measured for the comparison to identify the suitable combination of the ZnO nano particle in AA6070 aluminium alloy.

Section snippets

Experimental procedure

By using the stir casting method composites were prepared with the standard procedure. The AA6070 alloy used in the condition of heat treated with 1200OC to obtain the initial hardness and the percentage of elongation as 118 BHN and 10.50%. There are six composites created with the increase of the ZnO nanoparticle in the volume basis. The composites have

1. 0% of ZnO nano particle…
2. 2.5% of ZnO nano particle…
3. 5.0% of ZnO nano particle…
4. 7.5% of ZnO nano particle…
5. 10.0% of ZnO nano particle…
6. 12.5% of ZnO nano…

…

Results and discussion

The evaluated hardness of the all the created composite in BHN were clearly mentioned as a line diagram in Fig. 1 (a) and as Surface diagram in Fig. 1 (b) for the strong credentials of the deviations. The harness values such as 118 BHN, 125 BHN, 132 BHN, 140 BHN, 139 BHN and 136 BHN attained by the composite specimens having zero percentage, 2.5%, 5.0%, 7.5%, 10.0% and 12.5% of ZnO nano particle remaining with hardened aluminium alloy correspondingly.

Similarly, the Fig. 2 (a) and Fig. 2 (b)…

Conclusions

From this evaluation on hardness and percentage of elongation discrepancy by Zinc oxide nanoparticles on AA6070 alloy composites give the following as conclusions.

- The hardened AA6070 alloy properties can be increased with addition of ZnO nano particles in the total volume of the composites.…
- The percentage of elongation of ZnO nano particles added composite specimens were reached less significant values than AA6070 alloy specimen.…
- The ZnO nano particles mixed composite specimens were accomplished…

…

CRediT authorship contribution statement

R. Saravanan: Project administration, Supervision. **S. Rajesh:** Conceptualization, Writing original draft. **T.Kamatchi:** Methodology, Resources, Validation. **S.Ajith Arul Danield**: Investigation, Visualization. **C. Gnanavel**: Writing – review & editing. **D.K.Nagarathi:** Data curation, Formal analysis, Software.…

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.…

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