UNIVERSITI TEKNOLOGI MARA

CHARACTERIZATION OF ALUMINIUM – COPPER (Al – Cu) ALLOY METAL MATRIX COMPOSITES REINFORCED BY *IN SITU* ZIRCONIUM DIBORIDE (ZrB_2)

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Aluminium – Copper – Zirconium Diboride (Al – Cu – ZrB_2) composite have been plug through *in situ* reaction which promote mechanical abilities on top of dispersion strengthening together with grain refinement accessed by continuation of particular particulates inside the melt for the time being of solidification. Aluminium – Copper (Al – Cu) reinforced which was *in situ* by various proportion of Zirconium Diboride (ZrB_2) which were 0, 3 and 6 wt. % synthesized applying *in situ* fabrication at 800 °C of molten Al – Cu alloys by inorganic salts Potassium Hexafluorozirconate (K_2ZrF_6) mixed with Potassium Tetraflouroborate (KBF_4). The amalgam itemized using Potential-Dynamic Polarization (PDP) test on suitably segment which were metallographically qualified surface to criticize the corrosion rate itself. Several investigation using XRD, FESEM and mechanical also tested on appropriately sectioned and metallographically prepared surface in order to examine phase distribution, hardness together with tensile properties. From result, raised ZrB_2 amount has increase rate of tensile 74% which is 443 MPa and hardness increased 17.6 % with the addition of 6 wt. % ZrB_2 reinforcement particles to 147 Hv. XRD patterns exposed development of ZrB_2 particulates without existence of unspecified other compounds. Most of ZrB_2 granular were located near grain boundaries of Al dendrites. Microstructural investigation on alloy containing 6 wt. % of reinforcement discovered the homogeneous and persistent allocation of second phase particles, clean interface together with favourable bonding due to *in situ* reaction. It is promoting that ZrB_2 molecules are altogether in micro size amidst hexagonal either tetragonal shape, yet minor molecules in micron size were also noticed. For that intention, composite synthesized using *in situ* techniques indicated homogeneous disposal of reinforcing influenced to be superlative associated within pure interface all over metallic matrix. Outcome of dissimilar ZrB_2 percentages all over surface morphology, surface roughness, grain size of Al – Cu alloy were also inspected. Results displayed grain size drop off upon an increase of ZrB_2 content in the Al – Cu alloy. Furthermore, the surface roughness was seen to decrease to 1.44 Rα alongside greater ZrB_2 concentration of the deposited alloy. In corrosion test conducted, the addition of 6 wt. % ZrB_2 gave the good corrosion resistance which is 0.36×10^{-3} mmy^{-1} compare to unreinforced alloy which mean reinforced alloy has good properties in corrosion characterisation. The result obtained show that *in situ* Al – Cu alloy composites containing different weight of ZrB_2 phase were synthesized successfully using salt – metal reaction method.

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