Wear and hardness behavior of antimony-modified al-si-mg alloy under multiple thermal ageing condition
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Abstract
The wear and hardness property of thermally aged antimony-modified A356-type Al-Si-Mg alloy produce through sand casting process has been investigated. The antimony (Sb) was added in a trace amount (0.01\%) to modify and cause refinement of microstructure which led to an increase in hardness with a decrease in wear loss of the alloy. The study involve production of antimony-modified Al-Si-Mg alloy, thermal ageing treatment, wear test, hardness measurement, microstructure and surface morphology examination. Five samples of the produced alloy were subjected to solution heat treatment (T6) at 540°C for a soaking time of 1 hour, quenched in warm water, 40°C and then subjected to thermal ageing treatment at 120°C for 1-4 hours at one hour interval. One of the samples was further aged at 180°C for a soaking time of 2 hours. The samples were then subjected to wear test using Anton paar wear testing machine and the wear rate was found to be decreasing as the soaking time is increased. The wear rate value decreases from 0.1223 mm\textsuperscript{3}/N/m (control) to 0.003909 mm\textsuperscript{3}/N/m (for soaking time of 4 hours at 120°C) indicating a decrease of 68.04\%. The hardness value increases from 4.91 (control) to 8.43 (for soaking time of 4 hours at 120°C) indicating an increase of 41\%. Improvement in hardness value can be attributed to fine coherent clusters precipitate which serves as obstacles to the movement of dislocation.

SEM micrograph shows the wear track of the specimen with the least wear lost while optical microscopy was used to reveal the microstructure of all the samples used.

Keyword: Aluminium alloys, Pre-ageing treatment, GP zones, Soaking time, engineering materials
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