Investigation of the Ageing Behavior of As-Cast A356 Aluminium Alloy

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ABSTRACT

Pure aluminum has mechanical properties that are not suitable when it comes to strength factor for commercial uses. Aluminum alloy has been proven to be highly valuable in the car wheels manufacturing industries as well as other industries which manufacture aluminum alloy based products which commonly is A356 Al alloy. Currently T6 heat treatment is used for A356 aluminum alloy to increase the hardness. The T6 heat treatment process uses artificial ageing which consists of further heating the material at relatively low temperatures (120-210°C) and it is during this stage that the precipitation of dissolved elements occurs. These precipitates are responsible for the strengthening of the material. It is theorized that the ageing temperature and the ageing time interval plays a big factor in the formation of precipitate that determines the peak hardness that can be achieved within acceptable industrial manufacturing time. The T6 heat treatment is highly efficient process and beneficial to the manufacturing industry, but the additional cost and the time taken to produce the alloy are some of the setbacks that need to be overcome. This report aims to find the suitable peak hardness along with a fitting ageing process temperature and time that can reduce time and cost as well as increase production. The sample aluminium alloy was received in as-cast condition from AAI (Aluminium Alloy Industries (M) Sdn. Bhd.). The sample consists of four main parts of rim which is the outer & inner flange, spoke and profile. The sample was then cut into smaller pieces, heat treated, grinded and polished before performing hardness test and observing the precipitate distribution in A356 microstructure. The objective of the present work is to establish the hardness vs ageing time curve, microstructure examination for different heat treatment conditions was observed and optimization of the heat treatment was done with a more detailed understanding of the precipitation process. The present experimentation involved cases with different temperatures and the amount of time taken for artificial ageing. The results show that it is possible to reach a high level of hardness within a short period of time as compared as-cast condition. The 2-step ageing process is also analyzed to compare the peak age period and hardness level of the material. 2-step results are then compared with the three different ageing temperatures to conclude which has the most suitable peak hardness for commercial use.