Abstract

The aluminium foil production is a multi-step cold rolling processes with intermediate annealing and final annealing treatments. The high tensile strength without the loss of ductility, lesser porosity and non-earing properties are prime criteria for good quality foils and these are controlled by the optimal grain size and proper texture. The required grain size and texture of the foils are maintained by the proper selection of processing conditions.

For the present research work, two packaging alloys AA1235 (Al-0.67Fe, 0.17Si, 0.012Ti (all in wt %)) and AA8011 (Al-0.81Fe, 0.59Si, 0.018Ti (all in wt %)) have been chosen to study the recrystallization behaviour and mechanical properties at different annealing conditions. The alloys contain the solute in a supersaturated solid solution under the as–cast condition, and a small volume fraction of precipitates form during cold rolling. The amount of precipitation varies with the annealing temperature and time, and subsequently affects the recrystallization behaviour. Alloy AA8011 shows a higher precipitation rate compared to AA1235 owing to its higher concentration of alloying elements. Fine precipitates formed during recrystallization also delay the start and completion of recrystallization. At a low temperature annealing, precipitates formed are very fine (< 1 μm) and they inhibit the grain boundary migration. Recrystallization occurs by the migration of subgrain boundary and in some cases by strain induced boundary migration. After the completion of recrystallization, grain growth does not take place until precipitates start to dissolve and mechanical properties are also not affected during that period. At this moment, an inhomogeneous pinning of precipitates at the grain boundary leads to inhomogeneous distribution of grain sizes. At 480°C, some precipitates start to increase in size by the dissolution of others. This results in an increase in grain size affecting mechanical properties. The size of precipitates increases to more than 1 μm after 2 h of annealing at 480°C. Abnormal grain growth also takes place while dissolution of precipitates takes place. Eight hours of annealing at the same temperature gives a strong cube texture which is beneficial in controlling the growth of recrystallized

grains during final annealing by the orientation pinning effect. It is known that coarser particles (>1 μm) help particle stimulated nucleation (PSN) during final annealing of foil leading to a continuous recrystallization. It results in a fine grain size which is a requirement for a compromise between the strength and ductility of the foil products. Hence, 8 h of annealing at 480°C can be implemented in industrial level to improve the foil properties as well to save power.