Effect of Varying Zener-Hollomon Parameter (Temperature and Flow Stress) and Stress Relaxation on Creep Response of Hot Deformed AA3104 Can Body Stock

Authors : Oyindamola Kayode, Sarah George, Roberto Borrageiro, Mike Shirran

Abstract : A phenomenon identified by our industrial partner has experienced sag on AA3104 can body stock (CBS) transfer bar during transportation of the slab from the breakdown mill to the finishing mill. Excessive sag results in bottom scuffing of the slab onto the roller table, resulting in surface defects on the final product. It has been found that increasing the strain rate on the breakdown mill final pass results in a slab resistant to sag. The creep response for materials hot deformed at different Zener-Holloman parameter values needs to be evaluated experimentally to gain better understanding of the operating mechanism. This study investigates this identified phenomenon through laboratory simulation of the breakdown mill conditions for various strain rates by utilizing the Gleeble at UCT Centre for Materials Engineering. The experiment will determine the creep response for a range of conditions as well as quantifying the associated material microstructure (sub-grain size, grain structure etc). The experimental matrices were determined based on experimental conditions approximate to industrial hot breakdown rolling and carried out on the Gleeble 3800 at the Centre for Materials Engineering, University of Cape Town. Plane strain compression samples were used for this series of tests at an applied load that allow for better contact and exaggerated creep displacement. A tantalum barrier layer was used for increased conductivity and decreased risk of anvil welding. One set of tests with no in-situ hold time was performed, where the samples were quenched after deformation. The samples were retained for microstructure analysis of the micrographs from the light microscopy (LM), quantitative data and images from scanning electron microscopy (SEM) and energy dispersive X-ray (EDX), sub-grain size and grain structure from electron back scattered diffraction (EBSD).

Keywords : aluminium alloy, can-body stock, hot rolling, creep response, Zener-Hollomon parameter **Conference Title :** ICAAA 2023 : International Conference on Aluminium Alloys and Applications **Conference Location :** Ottawa, Canada **Conference Dates :** July 03-04, 2023