World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:11, No:10, 2017

Hot Deformability of Si-Steel Strips Containing Al

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Abstract : The present work is dealing with 2% Si-steel alloy. The alloy contains 0.05% C as well as 0.85% Al. The alloy under investigation would be used for electrical transformation purposes. A heating (expansion) - cooling (contraction) dilation investigation was executed to detect the a, a+g, and g transformation temperatures at the inflection points of the dilation curve. On heating, primary a was detected at a temperature range between room temperature and 687 ^oC. The domain of a+g was detected in the range between 687^oC and 746^oC. g phase exists in the closed g region at the range between 746^oC and 1043 ^oC. The domain of a phase appears again at a temperature range between 1043 and 1105 ^oC, and followed by secondary a at temperature higher than 1105^oC. A physical simulation of thermo-mechanical processing on the as-cast alloy was carried out. The simulation process took into consideration the hot flat rolling pilot plant parameters. The process was executed on the thermo-mechanical simulator (Gleeble 3500). The process was designed to include seven consecutive passes. The 1st pass represents the roughing stage, while the remaining six passes represent finish rolling stage. The whole process was executed at the temperature range from 1100^oC to 900^oC. The amount of strain starts with 23.5% at the roughing pass and decreases continuously to reach 7.5 % at the last finishing pass. The flow curve of the alloy can be abstracted from the stress-strain curves representing simulated passes. It shows alloy hardening from a pass to the other up to pass no. 6, as a result of decreasing the deformation temperature and increasing of cumulative strain. After pass no. 6, the deformation process enhances the dynamic recrystallization phenomena to appear, where the z-parameter would be high.

Keywords : si- steel, hot deformability, critical transformation temperature, physical simulation, thermo-mechanical processing, flow curve, dynamic softening.
Conference Title : ICMFT 2017 : International Conference on Material Forming Technologies
Conference Location : London, United Kingdom
Conference Dates : October 19-20, 2017

Open Science Index, Materials and Metallurgical Engineering Vol:11, No:10, 2017 publications.waset.org/abstracts/76819/pdf