

Nazlin Bayat

Doctoral Thesis: Investigation of Surface Formation in As-Cast and Homogenized 6xxx Al Alloy Billets

Abstract

The direct chill (DC) casting technique to produce billets for extrusion and ingots for rolling was developed in the 1930s. The principle, which is still valid, is a two-stage cooling with a primary cooling at a mould surface followed by water spraying directly on the surface. Improvements of this technique have mainly focused on changes to the primary cooling to minimize cooling at this stage. The drive for development comes from the extrusion industry, which can increase the productivity and quality of extruded profiles by improving the billet surface appearance and structure. The goal is to minimize the depth of the surface segregation zone, which is the governing factor for the appearance of different phases in the surface region. To achieve extruded products with a high surface quality the as-cast billets are heat-treated before extrusion. In this research the formation of the surface segregation for smooth defect-free surfaces in both as-cast and homogenized billets was studied. In addition, the surfaces with defects such as wavy, spot and vertical drag defects were investigated and possible mechanisms for initiation of those defects were explained. Moreover, for a better understanding of the homogenization process studies of the heat treatment of some 6xxx Al alloys were carried out by using an in-situ transmission electron microscope (TEM). Based on the observations, an explanation of the probable mechanisms taking place during transformation from β - to α -phase was presented.