

ELECTROMAGNETIC CASTING INFLUENCE ON THE MECHANICAL PROPERTIES OF AS-CAST 7075 Al ALLOY

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ABSTRACT

One of the novel processes aimed to obtain the better quality of aluminum alloys is the application of electromagnetic field during the casting process. The better ingot surface together with the homogeneous fine-grained microstructure guarantees the better mechanical properties of the ingot. The mechanical characteristics, such as elongation, reduction area, yield point, tensile strength as well as flow curves, were determined using computerized materials testing machine Zwick/Roel Z 100. The hardness was determined according to Brinell hardness test. The three sets of samples were used – two sets casted with the presence of electromagnetic field, but with different operating conditions and one set of samples obtained without electromagnetic field (EMF) presence. Besides the EMF influence, the examinations revealed the ingot diameter influence on the mechanical characteristics of the 7075 Al-alloy.

Keywords: 7075 Al-alloy, electromagnetic casting (EMC), mechanical characteristics

INTRODUCTION

The application of electromagnetic casting (EMC) has been aimed at first for obtaining a better ingot surface, due to the reduced contact pressure at the metal/mould interface as the result of potential force acting, as a horizontal component of the Lorentz force density [1-5]. The other component of the Lorentz force density is a rotational component, resulting in a forced convection in the molten metal, enabling better flow of the melt and homogeneous bulk distribution of alloying elements [6-10]. This ensures better and more uniform structure and mechanical characteristics. The recent researches have shown that by combining the main operating parameters, such as frequency and strength of electromagnetic field, this process can efficiently eliminate the other defects of as cast ingots and enable savings in energy and time.

The investigations on the effect of electromagnetic, magnetic and hydrodynamic phenomena on Al ingots started over a decade ago [11-14]. Our previous research was aimed to examine the microstructure of electromagnetic casted Al-alloys [6,14]. In this paper the special attention was paid to the effect of electromagnetic field on the mechanical properties. Knowing the microstructure-mechanical properties correlation, it is possible to obtain preferred ingot properties by controlling the main operating parameters and at the same time to avoid the needs for additional operations, such as machining and prolonged homogenization.

EXPERIMENTAL

The EN AW 7075 alloy is heat treatable very high strength alloy with wide application in aero and military industry. The chemical composition of the alloy is shown in Table 1. It is characterized by a number of defects that occur during the

