Heat Treatment of Mg-7Sn-1Si Magnesium Casting Alloy

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Magnesium alloys are characterised by the lowest density among the commercial metallic structural materials. What is more, they posses acceptable mechanical properties, so their specific strength and stiffness are comparable to these, exhibited by aluminium alloys or even some kinds of steels or titanium alloys. The main disadvantage of magnesium alloys is their low maximal working temperature. Improvement of their properties in elevated temperature may be achieved by addition of expensive rare earth elements. These additives may be however replaced with elements such as silicon or tin. The following paper presents results of the research on heat treatment influence on microstructure and properties of gravity cast Mg-7Sn-1Si alloy. The alloy underwent solution treatment at 520°C in 23h in Ar atmosphere, followed by aging at 200, 250 and 300°C in 4÷200h. The investigation included light microscopy, scanning and transmission electron microscopy, x-ray phase analysis as well as Vickers hardness measurements. It has been stated, that microstructure of Mg-7Sn-1Si alloy in as-cast condition consists of α-Mg solid solution and intermetallic phases such as Mg2Sn and Mg2Si, forming eutectic mixtures with the α-Mg solid solution. After solution treatment, Mg2Sn phase dissolves in the alloy matrix, while the Mg2Si phase undergoes spheroidization. During aging treatment, platelet Mg2Sn phase precipitates from the supersaturated solid solution. Ageing temperature and time influence morphology, size and volume fraction of Mg2Sn phase precipitates. The highest hardness of the alloy was observed after 20h of aging at 250°C.

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High Temperature Mechanical Behavior of Plasma-Nitrided Inconel 625 Superalloy

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INCONEL 625 superalloy (21.5 Cr, 9.0 Mo, 3.6 Nb, 2.5 Fe, 0.25 Mn, 0.2 Ti, 0.2 Al, 0.05 C, Ni balance) is used in marine environments, aerospace components and nuclear reactors due to its high strength, excellent fabricability, and outstanding corrosion resistance. However, this alloy has limitations on the use at temperatures above 600°C. For this reason, protective coatings can be used as barriers to avoid both nucleation and crack propagation. The aim of this work is to evaluate the mechanical properties of non-nitrided and nitrided samples of INCONEL 625 superalloy through high temperature tensile tests at 600, 700, 800, 900 and 1000°C with deformation speed between 10-4 and 10-5 s-1. The surface of the alloy was modified by plasma nitriding at 520°C. Microstructural characterization of the nitrided layer was performed by optical microscopy (OM), scanning electron microscopy (SEM) and X-ray diffraction (XRD). The results have shown that the nitrided sample presented expanded fcc phase and chromium nitride (CrN). The presence of CrN was evident by the two peaks at 37.5° and 42.5°. It can be seen that plasma nitriding of Inconel 625 shifts the (111) peak from 43.6° to 43° and the (200) peak from 50.7° to 49.5°. The different amount of shifting in peak position of (111) and (200) was attributed to the lower atomic density of the latter plane, resulting in larger lattice expansion. Tensile tests showed that there was no

significant difference in the yield strength and elongation between non-nitrided and plasma-nitrided samples at the same temperature. Serrated stress–strain behavior was observed in the curves obtained at 600 and 700°C, which is associated with dynamic strain aging effect. At 600°C, the increasing in the strain rate promoted an increasing in the amplitude and oscillation frequency of the stress.

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Influence of Loading Ratio and Loading Orientation on Fatigue Behaviour of Lateral Notched Round Bars under Bending-Torsion

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High strength steels cover a broad spectrum of applications due to both good strength-to-weight ratio and corrosion resistance. These features make it ideal for critical components, such as shafts, axles, torsion bars, bolts, crankshafts, connecting rods, among others. Inevitably, for functional purposes, such components contain severe geometric discontinuities, generally termed notches, which make them susceptible to fatigue failure. In this sense, both notch geometry and notch orientation with regard to the acting loading are key aspects in design [1].
This paper addresses the fatigue behaviour of lateral notched round bars made of DIN 34CrNiMo6 high strength steel under bending-torsion loading. Different geometries and loading scenarios are investigated. In relation to the former, two notch depths and two notch widths are considered. In relation to the latter, three ratios of the bending moment to the torsion moment as well as three planes of application of the bending loading with respect to the notch root are examined. Crack initiation and crack growth are monitored in-situ using a high-resolution digital system. Fracture surfaces are examined by scanning electron microscopy in order to identify the main failure mechanics. Fracture surfaces are replicated with a three-dimensional laser scanner to better evaluate the degree of out-of-plane propagation. Finally, fatigue life is predicted using the Coffin-Manson model. The notch effect is evaluated using the Equivalent Strain Energy Density concept.
[1] Socie D, Marquis G (2000). Multiaxial Fatigue. Society of Automotive Engineers, ISBN: 0-7680-0453-5.

ACEX403
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Learning Techniques to Optimize Fault Detection

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Wind energy is a very well-liked renewable resource for its availability and environmentally friendly features. Condition Monitoring (CM) and fault diagnosis are critical aspects of wind turbine safety and