MONDAY, AUGUST 22, 2005, P.M.

SESSION 6: INTERNATIONAL SYMPOSIUM ON LIGHT METALS

MAGNESIUM TECHNOLOGY
Sponsor(s): Light Metals Section, The Metallurgical Society of CIM
Room: Neilson 1
Chair(s): A. FAUCHER, Norsk-Hydro, Canada and
M. PEKGULERYUZ, McGill University, Canada

PAPER 6.1—14:00
TENSILE PROPERTIES AND FRACTURE BEHAVIOR OF SQUEEZE CAST MAGNESIUM ALLOY AM50.
H. HU, M. ZHOU, University of Windsor, Canada
N. LI, Ford Motor Company, U.S.A. and
J. LO, Natural Resources Canada, Canada

Most of automotive magnesium applications are presently produced by high-pressure die casting processes. For further expansion of the alloy usage in automobiles, novel-manufacturing processes needs to be developed. In this study, squeeze casting of AM50 alloy was carried out using a hydraulic press with an applied pressure of 70 MPa. Tensile properties and fracture behavior of the squeeze-cast AM50 were characterized in comparison with the die cast counterpart. The squeeze-cast AM50 alloy exhibits virtually no porosity in the microstructure evaluated by optical microscopy. The results of tensile testing indicate that the improved tensile properties for the squeeze-cast samples over the conventional high-pressure die-cast parts. The analysis of tensile behavior shows that the strain-hardening rate during the plastic deformation of the squeeze-cast specimens is constantly higher than that of the die-cast specimens. The SEM fractography evidently reveals the ductile fracture features of the squeeze-cast alloy AM50.

PAPER 6.2—14:25
EFFECT OF GRAIN REFINEMENT ON THE TENSILE AND FATIGUE CRACK GROWTH PROPERTIES OF SAND CAST AM60 MAGNESIUM ALLOY.
M. MAHFOUD, S. YANNACOPOULOS, University of Saskatchewan, Canada and
D. EMADI, Natural Resources Canada, Canada

The effect of grain refinement on the tensile and fatigue crack propagation behavior of sand cast magnesium alloy AM60B has been investigated in the present study. C_2Cl_6 in the amount of 0.3% was used to grain refine the melt. The fracture toughness tests were conducted in laboratory air at room temperature (25^{o}C) using a sine-wave cyclic frequency of 20Hz and a load ratio of R = 0.1. The response in the Paris's regime and the critical stress range were determined. Preliminary findings have shown that C_2Cl_6 has a significant effect on both the tensile properties and fatigue crack propagation of the alloy tested. Grain refinement increased both the yield and ultimate tensile strength by more than 46%, and decreased the crack growth rate from 2.7 to 1.4 MPa$\sqrt{m}$. However, the grain size seems to have a smaller effect on threshold stress intensity factor range. The fracture surfaces of specimens were examined optically and under the scanning electron microscope (SEM) to determine the relationship between grain size and fatigue properties.

PAPER 6.3—14:50
THERMAL ANALYSIS OF AZ91-E MAGNESIUM ALLOY CAST BY THE LFC PROCESS.
L. BICHLER, C. RAVINDRAN, Ryerson University, Canada and
M. SAHOO, CANMET, Canada

Utilizing thermal analysis techniques, pioneering research into the solidification mechanism of a popular magnesium alloy AZ91E cast by the Lost Foam Casting (LFC) process was carried out. Foam characteristics, section thickness and application of vacuum were seen to have profound effect on the cooling rate, thermal gradients and casting temperature profiles.

COFFEE BREAK—15:15-5:45

PAPER 6.4—15:45
CORROSION PROPERTIES OF THE SKIN OF HIGH PRESSURE DIE CAST AZ91 ALLOY.
C. BLAWERT, E. MORALES, V. HEITMANN, W. DIETZEL, GKSS Research Center, Germany
E. GHALI, S. JIN, Université Laval, Canada and
S. MAENDL, Leibniz-Institut fur Oberflachenmodifizierung, Germany

In previous studies of various HPDC magnesium alloys we found that the corrosion properties of the skin are inferior in comparison to the bulk. However, this is surprising as one would expect better corrosion properties for the finer microstructure of the skin. In a more detailed study using 2 and 6 mm thick sections from HPDC AZ91 step plates, the corrosion results of the original skin, the slightly removed skin and the bulk were compared. Indeed, the corrosion measurements including potentiodynamic polarization, long term polarization resistance measurements and electrochemical impedance spectroscopy (EIS) revealed a lower corrosion resistance of the original as-cast skin. An explanation for this corrosion behavior was found, on the one hand, in the microstructure concerning especially the amount and distribution of the ß-phase and, on the other hand, in the composition, including the distribution of the most important alloying element Al and of some impurities such as Fe.

PAPER 6.5—16:10

INVESTIGATION TO THE HOT WORKING BEHAVIOUR OF AZ31 MAGNESIUM ALLOY.

S.M. FATEMI-VARZANEH and A. ZAREI-HANZAKI, Tehran University, Iran

The AZ31 magnesium alloy is considered as a promising alloy in various applications and industries. Furthermore, to design a proper hot working process (rolling, forging and extrusion), the assessment of hot working behaviour of the alloy is necessitated. Accordingly, the hot deformation behaviour of AZ31 alloy was studied through hot compression testing method. The latter was carried out in a wide range of temperature (473 K to 783 K) and strain rates. The obtained true stress-true strain curves and final microstructures were examined and a partial melting was realized at 740 K. It was concluded that the presence of liquid did change the deformation mechanisms thereby affecting the flow behaviour.