TUESDAY, AUGUST 24, 2004, P.M.

SESSION 30: INTERNATIONAL SYMPOSIUM ON LIGHT METALS AND METAL MATRIX COMPOSITES

MAGNESIUM TECHNOLOGY
Sponsor: Light Metals Section, The Metallurgical Society of CIM
Room: 202
Chairmen: A. FAUCHER, Norsk-Hydro, Bécancour, Québec, Canada, and
M. PEKGULERYUZ, McGill University, Montreal, Quebec, Canada

PAPER 30.1 — 14:00
STRUCTURAL TRANSFORMATIONS OF MAGNESIUM ALLOYS DURING THIXOMOLDING.
F. CZERWINSKI, Husky Injection Molding Systems Ltd., Bolton, Ontario, Canada

The application of Thixomolding technology for the processing of magnesium alloys is presented. The fundamentals of the generation of thixotropic forms during melting and solidification, as well as the requirements imposed on potential alloys, are described along with the critical technological parameters affecting the process. It is shown that correlating the temperature distribution along the alloy flow path within the system and shear action of the injection screw, allows the generation of a variety of unique morphologies. The constituents of thixotropic microstructures within Mg-Al, Mg-Al-Zn, Mg-RE and Mg-Al-RE alloys, are analyzed with special attention being paid to the morphology, size and internal structure of the primary solid particles. For selected alloys, the relationship between the microstructure and mechanical properties is explored within a wide range of processing temperatures.

PAPER 30.2 — 14:25
FORMATION OF MGOHCL DURING DEHYDRATION OF MAGNESIUM CHLORIDE HYDRATES BY CONTACTING WITH MOLTEN SALT.
M. TAWALBEH, K.W. NG and R. HARRIS, McGill University, Montréal, Québec, Canada

The temperature history of a single MgCl2 hydrates particle when in contact with hot fused salt electrolyte was numerically stimulated with the measured heat transfer coefficient from the molten salt bath at 650°C. The results revealed that the entire interior of the particle reached the temperature required for the formation of MgOHCl from hydrated MgCl2 in less than 3.5 second, which was much less than the time required for dissolution of the prills observed in the experiments. It is very likely that the formation of MgOHCl during prill dehydration and dissolution is a result of hydrolysis in the interior of the prills.

PAPER 30.3 — 14:50
KINETIC ANALYSIS OF MG2(OH)3CL THERMAL DECOMPOSITION.
S. KASHANI-NEJAD, K-W. NG and R. HARRIS, McGill University, Montréal, Québec, Canada

Kirsh et al. identified Mg2(OH)3Cl as a product of dehydration of bischofite and hydrolysis in air. This particular member of the magnesium ‘hydroxychlorides’ group has also been found in the mixture of magnesium chloride hydrates prepared in an industrial fluidized bed dryer under HCl-H2O atmospheres. In this paper, the kinetics of Mg2(OH)3Cl decomposition was investigated using ‘Isothermal & Non-Isothermal Thermogravimetric (TG)’ analysis. Decomposition TG curves of samples were obtained for 300, 400, 500, and 600 oC test and results were compared with the XRD spectra of decomposition products. Kinetic analysis of the curves was performed and Arrhenius parameters A and E and the model function that best describes the reaction mechanism were evaluated for the decomposition reaction.

COFFEE BREAK — 15:15 - 15:45

PAPER 30.4 — 15:45
EFFECT OF AL AND MN ON TENSILE PROPERTIES OF AZ91E CAST BY LFC.
L. BICHLER and C. RAVINDRAN, Ryerson University, Toronto, Ontario, Canada

Lightweight magnesium alloys are gaining popularity in recent years for applications in the automotive and aerospace industries. Their application remains limited, however, due to relatively low strength and creep properties, as compared to for example aluminum alloys. Strength of cast magnesium alloys produced by the Lost Foam Casting process has not been investigated in great detail so far. In this research, magnesium alloy AZ91E and four new alloys were cast by LFC method to study the effect of varying Al and Mn content on the alloy’s tensile properties.

The study reveals, that the tensile strength of the magnesium alloy is closely related to the relative levels of aluminum present in the system. Formation of eutectic Mg17Al12 phase was seen to affect the yield strength and

ductility of the alloy. Furthermore, formation of Mn-crystals with small additions of manganese to the magnesium alloy was also seen to effectively increase the yield strength of the alloy. The different levels of alloying as well as modes of fracture were related to the microstructure of the alloy via optical image analysis and scanning electron microscopy.

PAPER 30.5 —16:10

DYNAMIC RECRYSTALLISATION IN COARSE-GRAINED AZ31 ALLOY AT ELEVATED TEMPERATURES.

L. JIANG, J.J. JONAS, McGill University, Montréal, Québec, Canada,
G. HUANG, Chongqing University, Chongqing, China, and
A.A. LUO, General Motors Research and Development Center, Warren, Michigan, U.S.A.

Compression tests were conducted on a coarse-grained as-cast magnesium alloy containing lamellar Mg17All2 eutectic phase and (Al, Mn) particles. The micro structural evolution was followed during both warm and hot deformation and it is shown that dynamic recrystallization (DRX) took place, particularly in the vicinity of the Mg17Al12 particles. Particle stimulated nucleation was associated mostly with the breakdown of the lamellar Mg17All2 particles and depended sensitively on the deformation conditions and particle parameters. The effect of twinning on DRX was also examined.