TUESDAY, AUGUST 23, 2005, P.M.

SESSION 26: INTERNATIONAL SYMPOSIUM ON LIGHT METALS

CASTING AND SOLIDIFICATION OF ALUMINIUM II
Sponsor(s): Light Metals Section, The Metallurgical Society of CIM
Room: Neilson 2
Chair(s): M. SAHOO, CANMET-Materials Technology Laboratory, Canada and
J-P. MARTIN, CNRC- Aluminium Technology Centre, Canada

PAPER 26.1—14:00
STUDIES IN THE CASTING OF AA6111 STRIP ON A HORIZONTAL, SINGLE BELT, STRIP CASTING SIMULATOR.
D. LI, S.G. SHABESTARI, J. KIM, M. ISAC and R.I.L. GUTHRIE, McGill University, Canada

Strips of AA6111 automotive alloy were cast on a horizontal single belt strip casting simulator. Pure copper and carbon steels substrates plasma sprayed with different coatings for improving the strip surface quality, were used as chill moulds. Experimental studies revealed that a graphite coating provided the greatest benefit in achieving good surface quality. The interfacial heat fluxes during solidification of AA6111 strip were calculated by the IHCP method (Inverse Heat Conduction Problem). Temperature variations and cooling rates within the strips were then calculated through numerical simulations based on the time-dependent heat fluxes obtained by IHCP. The effects of casting parameters, including casting temperature and strip thickness, on interfacial heat fluxes, cooling rates and microstructures, were investigated. Although the maximum interfacial heat fluxes on the chill copper substrate were much higher than the results obtained from the steel substrates, the solidification times of the melts were mainly determined by strip thickness. Very fine equi-axed grains were obtained for both 1.2mm and 2.5mm thick strips thanks to the rapid extraction of heat, and effective grain refinement.

PAPER 26.2—14:25
SEED TECHNOLOGY: NEW GENERATION IN RHEOCASTING.
S. NAFISI, O. LASHKARI, R. GHOMASHCHI, Universite du Québec à Chicoutimi, Canada
J. LANGLAIS, Alcan R&D Center of Arvida, Canada and
B. KULUNK, Societe des Technologies de l`Aluminium du Saguenay Inc., Canada

Permanent mould casting may be regarded as a near net shape manufacturing process where simple to very complex shaped engineering components are fabricated with high degree of precision in a metallic mould. In this group High Pressure Die Casting, HPDC, have attracted more attention because of its production rate, where both liquid and semisolid material (SSM) can be cast with a great degree of precision and versatility. In the HPDC of SSM processing, new process is described. The SEED process, Swirled Enthalpy Equilibration Device, consists of two steps: The initial step involves extracting specified amount of heat from the molten metal to generate liquid-solid slurry, i.e. mushy structure, followed by drainage of remaining liquid to produce a compact feedstock for rheocasting operation. In this paper microstructural evolution during the process and some initial casting result of automotive components also reported.

PAPER 26.3—14:50
INFLUENCE OF SR AND MN ADDITIONS ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF FE-RICH AA319 ALUMINIUM ALLOYS.
P. ASHTARI, H. TEZUKA and T. SATO, Tokyo Institute of Technology, Japan

Influence of Sr and Mn single and combined additions on the microstructure and mechanical properties of Fe-containing AA319 Aluminium alloys has been studied. The microstructural features e.g. morphology of the Fe compounds and eutectic Si have been correlated to the mechanical properties. It was demonstrated that the modification of the Fe compounds from the platelet beta- to the Chinese script alpha-compound improves the UTS and elongation of the alloys by 10.3% and 83.9%, respectively. Moreover, the simultaneous modification of the Fe compounds and eutectic Si increases the UTS and elongation of the alloys by 15.3% and 116.1%, respectively.

COFFEE BREAK—15:15-15:45

PAPER 26.4—15:45
SURFACE DAMAGE AND PHASE FRAGMENTATION IN AL-SI ALLOYS DURING SINGLE PASS SCRATCH TESTS.
M. CHEN and A. ALPAS, University of Windsor, Canada

The fracture behavior of second phase particles and the role of matrix material on the wear resistances of the three Al-Si alloys containing 8, 17, and 19% Si were investigated using single pass scratch testing technique by applying normal loads between 0.15 and 5.00 N, in ambient air. Optical microscopy and SEM with EDS were used to analyze

microstructures and morphologies of scratch tracks of the Al-Si alloys. The results showed that needle-like Si particles fractured under a load of 0.50 N, while block-like Si particles fractured at loads above 3.00 N. The Al-17% Si alloy with large number of needle-like particles (area fraction 16.4%) exhibited the highest coefficient of friction (0.8) and the widest scratch track. The Al-19%Si alloy containing high Si percentage and larger number of block-like particles (area fraction 16%) exhibited the lowest coefficient of friction (0.37) and the narrowest scratch track width. Presence of block-like particles was effective in reducing the amount of material transfer from Al-Si alloy surfaces to the counterface.

PAPER 26.5—16:10

EFFECT OF DEEP CRYOGENIC TREATMENT ON MECHANICAL PROPERTIES OF A319 ALUMINUM ALLOY.

F. KHOMAMIZADEH, S. KHOSHKHOOEI, Sharif University of Technology, Iran
S.-K. SERESHT, Iran Khodro Co., Iran and
R. SHAHKOOHI, Iran University of Science and Technology, Tehran, Iran

In this study, deep cryogenic treatment was applied to A319 cast aluminum samples. Although the cryogenic treatment didn't have any significant effect on mechanical properties of the well degassed and fluxed samples, but the tensile strength of the samples containing a considerable amount of gas and shrinkage defects was improved surprisingly. This improvement was attributed to the strengthening of the α-aluminum matrix which slows down the propagation of the existing defects. There was no significant increase in the hardness after cryogenic treatment. The abrasion resistance of the alloy was improved after cryogenic treatment, by developing a homogeneous protector shield, composed of abrasive grains penetrated into the soft aluminum matrix and kept tight.

PAPER 26.6—16:35

EFFECT OF COOLING RATE AND HEAT TREATMENT ON THERMAL FATIGUE BEHAVIORS OF ALUMINUM A319 CASTING ALLOY.

F. KHOMAMIZADEH, M. RAJABI, S. KHOSHKHOOEI, Sharif University of Technology, Iran and
M.F. ARDEBILI, Iran Khodro Co., Iran

In this study the effect of solidification rate, T6 and T7 heat treatments on thermal fatigue resistance of A319 aluminum was investigated. Increasing of the solidification rate improved the thermal fatigue resistance of the alloy by refinement of the microstructure. The most sensible areas for thermal fatigue crack growth were the eutectic zones. T6 and T7 heat treatments improved the thermal fatigue resistance of the alloy by enhancing of the matrix resistance against the crack propagation. The slight reduction of the thermal fatigue resistance after T7 heat treatment is attributed to coarsening of the precipitates which reduces the matrix resistance.