MONDAY, AUGUST 23, 2004, P.M.

SESSION 5: INTERNATIONAL SYMPOSIUM ON LIGHT METALS AND METAL MATRIX COMPOSITES

ALLOY TECHNOLOGY
Sponsor: Materials Performance and Integrity Section, The Metallurgical Society of CIM
Room: 202
Chairmen: M. SAHOO, CANMET, Ottawa, Ontario, Canada, and
G. DUFOUR**,** Alcoa Primary Metals, Montreal, Québec, Canada

PAPER 5.1 — 14:00
MECHANICAL PROPERTIES OF 3XX ALUMINUM ALLOY TEST BARS FROM THE ASTM B108 AND A MODIFIED MOULD IN AS-CAST AND HEAT-TREATED CONDITIONS.
D. EMADI, L.V. WHITING, P.D. NEWCOMBE and M. SAHOO, CANMET, Ottawa, Ontario, Canada

The ASTM B108 Mould and a Modified Mould were used to cast test bars under a variety of conditions: mould and pouring temperatures, mould tilt, and grain refinement. Mechanical properties were determined in the as-cast and heat-treated conditions. The ASTM Mould is less sensitive to casting variables. Enlarging the gating system and adding additional gates to the ASTM mould can improve properties in the tilt position. The reproducibility of properties in as-cast and T6 heat treated bars were investigated.

PAPER 5.2 — 14:25
MICROSTRUCTURES AND MECHANICAL PROPERTIES OF LOW AND HIGH PRESSURE DIE CAST MAGNESIUM AM50 ALLOY.
S. XU, J. LI, V.Y. GERTSMAN, J.P. THOMSON and M. SAHOO, CANMET, Ottawa, Ontario, Canada

AM50 alloy is of interest to automotive cradle application because of its excellent castability and good ductility. In this work, microstructures and mechanical properties of both low pressure die cast (LPDC) and high pressure die cast (HPDC) AM50 test bars are characterized. Mechanical tests were performed in conditions related to a cradle application. LPDC AM50 shows lower strength but better creep resistance than HPDC AM50 mainly due to the difference in grain sizes and grain boundary microstructures. Tensile-compressive yield and creep asymmetries of AM50 are discussed.

PAPER 5.3 — 14:50
STUDIES ON HOT WORKING AND MICROSTRUCTURE EVOLUTION OF ALUMINUM ALLOYS IN RUSSIA.
D.S. SALONINE and H.J. MCQUEEN, Concordia University, Montréal, Québec, Canada

Aluminum alloys offer a wide range of capability with a unique combination of advantages that makes them the materials of choice for numerous products and markets. One of the most important applications is their use as the primary structure and outer envelope in aerospace vehicles. Wide and thorough studies on hot working and microstructure evolution of aluminum alloys have been made in Russia. The most important appear to be:

-introduction of the structure diagrams in strain rate - temperature coordinates which show areas of different microstructures (non-recrystallized, recrystallized, and mixed) after hot deformation and subsequent heat-treatment for common aluminum alloys (Yu.M. Wineblat);

-clarification of the press-effect ("structural effect" by V.I. Dobatkin);

-determination of the influence of hot worked substructure on aging mechanisms;

-specifications for press heat-treatment.

These works allowed a deeper understanding and a better control of the mechanical behavior of aluminum products. Comparisons are made to equivalent developments in Europe and America.

COFFEE BREAK — 15:15 - 15:45

PAPER 5.4 — 15:45
EFFECT OF FE LEVEL, DIFFERENT MODIFIERS AND DIFFERENT MOUNTING TECHNIQUES ON MECHANICAL PROPERTIES OF HYPOEUTECTIC AL-SI ALLOYS.
A. ABDOLLAHI, Shellcast Foundry Inc., Montréal, Québec, Canada

Many factors affect mechanical properties of hypoeutectic Al-Si alloys. As examples the presence of impurities such as Mn and Fe due to the formation of intermetallic phases, additions of small amounts of alkaline earth metals and cooling rate in consideration of Si formation, they all have an impact on mechanical properties of hypoeutectic Al-Si alloys. In this investigation, the effect of Fe content into the specification range of A-357 alloy, the addition of different

modifiers consisting of Na, Sr and Ca for the alloy of A-356 and different mounting techniques for separately cast test coupons of hypoeutectic Al-Si alloys using the lost wax method were studied. The results showed that using material with lower Fe content and addition of modifiers improve mechanical properties. Also different mounting techniques resulted in different mechanical properties.

PAPER 5.5 — 16:10

FABRICATION OF SEAM WELDED ALUMINUM TUBE FOR HYDROFORMING.

P. MARTIN, D. BARAGAR, G. SHEN and D. DOLAN, CANMET, Ottawa, Ontario, Canada

Fabrication of aluminum tubes using roll forming and welding is an interesting alternative to tube extrusions for hydroforming. This technology is well developed for low-carbon steel but it is much less understood for production of aluminum tubes. It is a complex process since it involves good control over the roll forming conditions to minimized work hardening and optimization of the welding operation to avoid fracture at the weld during hydroforming. This paper describes results of an investigation of fracture during tube expansion of 5052 and 5754 aluminum seam welded tubes for hydroforming. Seam welded tubes were produced in laboratory by press forming of tubular blanks and pilot-scale tube high frequency induction welding. The effect of property mismatch between the weld and base metal has been investigated. The material work hardening was obtained by roll forming of sheet blanks in the 0-temper and H32 temper condition. The weld microstructure properties were varied by using different welding conditions. In this study a new test method has been used to simulate tube expansion using a jig to stretch tube coupons. The new technique has been used to evaluate weld integrity and forming property of the tubes. Significant workhardening can be present in base metal without causing weld fracture during tube expansion. The workhardening increases the yield strength mismatch between base metal and weld. Annealing contributes to reduce the hardness of base metal leading to more uniform deformation during tube expansion. As a result weld fracture occurrence is reduced. The study showed a significant deformation of the welds during tube expansion. Weld thinning can be as significant as parent material thinning before fracture. To avoid fracture at the weld joint good formability and high yield strength welds is needed. It has been shown that thinning of the weld can be reduced by minimizing the width of the weld joint.