TUESDAY, AUGUST 23, 2005, A.M.

SESSION 14: INTERNATIONAL SYMPOSIUM ON LIGHT METALS

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

PAPER 14.1—8:30
EFFECT OF WELDING SPEED ON ND:YAG LASER WELDABILITY OF ZE41A-T5 MAGNESIUM SAND CASTINGS.
M. MEDRAJ, H. AL KAZZAZ, Concordia University, Canada
X. CAO, M. JAHAZI and M. XIAO, NRC - IAR, Canada

The 2-mm butt joints of ZE41A-T5 sand castings were laser welded using 1.6 mm EZ33A-T5 filler wire and a continuous wave Nd:YAG system at a power of 4 kW, surface defocusing and various welding speeds. Compared with the base metal, the fusion zone showed significant grain refinement due to high cooling rate. No grain coarsening was observed in the heat affected zone (HAZ). The porosity area percentage and total solidification crack length in the fusion zone (FZ) were reduced as the welding speed increased from 4 to 7 m/min. Fusion zone area, total penetration depth, and weld width decreased with increased welding speed. The hardness in the FZ was similar to or higher than the base metal after a natural aging of about one year, but there was a drop in the hardness of the HAZ. The HAZ width decreased with increasing the welding speed. Tensile test showed that a joint efficiency of approximately 75 – 90 % was obtained.

PAPER 14.2—8:55
INFLUENCE OF GRAIN SIZE ON LOW TEMPERATURE FORMABILITY OF AZ31B SHEET.
S. JACOB and M. BARNETT, Deakin University, Australia

Magnesium sheet is notoriously difficult to form at low temperatures without initiating failure. In the present work cold rolling and annealing conditions are varied to produce samples of AZ31B sheet with a range of grain sizes. The formability of these samples is investigated using tensile testing and forming limit diagrams (FLD's). The results are discussed in terms of twin types and frequencies.

PAPER 14.3—9:20
DEVELOPMENT OF MANUFACTURING PROCESS OF WROUGHT MAGNESIUM ALLOYS BY SEMI-SOLID ROLL STRIP CASTING.
H. WATARI, Oyama National College of Technology, Japan
T. HAGA, Osaka Institute of Technology, Japan
K. DAVEY, UMIST, United Kingdom and
N. KOGA, Nippon Institute of Technology, Japan

In 1998, a voluntary agreement was reached between the European Commission and the European Car Manufacturers Association (ACEA) to reduce average carbon dioxide emissions of new cars to 25% below 1995 levels by 2008. Agreements have also been reached between the European Commission and the Japanese Automobile Manufacturers Association (JAMA) and the Korean Automobile Manufacturers Association (KAMA). However, the target average of carbon dioxide emissions of less than 140g/km in 2008 is a very challenging goal. Therefore, total product weight reduction is an objective for many manufacturers. This can be achieved utilizing materials possessing high strength and low weight. One material that has recently attracted interest is magnesium alloys. The magnesium alloys are expected to play an important role as next-generation materials, which have possibilities of contributing to lighten the total product weight when magnesium products can be used to replace aluminum and mild steel products.

PAPER 14.4—9:45
EFFECT OF RARE EARTHS ADDITION ON THERMAL FATIGUE BEHAVIORS OF AZ91 MAGNESIUM ALLOYS.
F. KHOMAMIZADEH, K. MESHINCHI ASL, S. KHOSHKHOOEI, Sharif University of Technology, Iran and
F. AJAYEBI, Iran Khodro Co. Vehicle Manufacturing, Tehran, Iran

In this research, the effects of rare earth elements addition on thermal fatigue behaviors of AZ91 alloy were studied. Repeated heating and cooling cycles were applied on the samples at 170˚C and 210 ˚C to develop thermal fatigue cracks. Crack growth mechanisms and microstructural influences were investigated by optical and scanning electron microscopy (SEM) as well as energy dispersive X-ray spectroscopy (EDS). Thermal fatigue behaviors were

improved successively by addition of up to 2-wt% RE. This improvement is attributed to consummation of the aluminum of the melt by precipitation of the needle shape $Al_{11}RE_3$ phases. This process reduces the volume of $Mg_{17}Al_{12}$ phases and consequently decreases the brittle $Mg/Mg_{17}Al_{12}$ interfaces which are the main reason of weak thermal properties of the alloy at rather high temperatures. Further additions of RE, however, reduced the thermal shock resistance of samples by increasing in the mean length of the brittle needle shape phases.

COFFEE BREAK—10:10–10:40