

## Ligh Weight Magnesium Alloy Corrosion Studied by Scanning Electrochemical Microscopy

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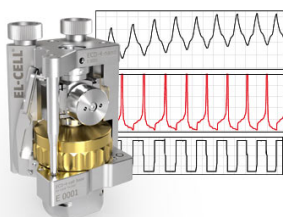
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LIGHT WEIGHT MAGNESIUM ALLOY CORROSION  
STUDIED BY SCANNING ELECTROCHEMICAL  
MICROSCOPY

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To develop the next generation of economically viable automobiles, a great amount of effort being focused on reduction of vehicle weight. One of the most promising routes to this end is the use of magnesium, which is the lightest commercially feasible structural metal. Mg components in automobiles should have good mechanical properties and good corrosion resistivity. The latter is highly dependent on alloying elements, microstructures and contact of the alloy with more noble metallic components. The role of the alloying elements in Mg corrosion remains ambiguous because the corrosion can be influenced by solute concentration, secondary phase composition, and the distribution of secondary phase. For example, Al modifies the passive film on both the alpha- and beta- phases (Mg<sub>17</sub>Al<sub>12</sub>) [1], and recent studies confirm that increased Al content improves corrosion resistance in salt sprays [2] humid vapor [3] conditions, and aerated 3.5% NaCl [4]. The higher Al content of the beta-phase makes it considerably more corrosion resistant than the alpha-phase. The simultaneous optimization of diverse casting, mechanical and corrosion properties is complex with many unresolved issues. The concentration of Al can also vary within the alpha-grains from a few % at the centre to > 10% close to the grain boundary [5], and damage accumulation mirrors this distribution being more extensive in the centre than at the periphery [6]. Clearly, control of Al distribution could have a significant influence on the corrosion. To distinguish these influences, well-designed experimental studies with controlled alloy microstructures are performed at both the sub-micron and micron levels. These experiments utilize advanced SECM and electron microscopy techniques and the results are used in corrosion simulation modeling.

References

1. G. L. Song, A. Atrens, X. Wu, Z. Bo and B. Zhang, *Corros. Sci.* 40, 1769(1998).
2. G. Ballerini, U. Bardi, R. Bignucolo and G. Ceraolo, *Corros. Sci.* 47, 2173(2005).
3. M. Jonsson and D. Persson, *Corros. Sci.* 52, 1077(2010).
4. A. Pardo, M. C. Merino, A. E. Coy, F. Viejo, R. Arrabal and S. Feliu, *Electrochim. Acta* 53, 7890(2008).
5. E. Ghali, W. Dietzel and K-U. Kainer, *J. Mat. Eng and Perform.* 13, 7(2004).
6. E. Ghali; *Magnesium and Magnesium Alloys*, In: Uhlig's *Corrosion Handbook*, Second Edition, edited by R. W. Revie, John Wiley and Sons, Inc. Chichester, U.K. 793(2000).