Predictive analysis of water wettability and corrosion resistance of secondary AlSi10MnMg(Fe) alloy manufactured by vacuum assisted high pressure die casting

Swaroop K. Behera¹, Amir Kordjazi², Arthur Jamel³, Ana Isabel Fernández-Calvo⁴, Pradeep Rohatgi²

¹Department of Materials Science and Engineering, University of Wisconsin Milwaukee, 53211 USA
²Department of Industrial and Manufacturing Engineering, University of Wisconsin Milwaukee, 53211 USA
³Department of Mechanical Engineering, University of Nantes, 44035 France
⁴AZTERLAN, Basque Research and Technology Alliance (BRTA), Aliendal Azuenea 6, 48200-Durango, Spain

INTRODUCTION

• Secondary Aluminum alloys are lucrative for the automotive industry; however, they have reduced ductility due to the formation of detrimental β intermetallics.
• A modified secondary aluminum alloy (AlSi10MnMg(Fe)) was developed to reduce the formation of these intermetallics.
• The focus of the current work is to study and predict the Elapsed Time on Wettability of Hypoeutectic Cast Aluminum

EXPERIMENTAL METHOD

• Microscopy (Optical and SEM) – Phase determination
• Confocal Microscopy – Roughness Measurements
• Linear polarization – Corrosion rate measurements
• Neural Network Model – Data prediction

RESULTS

ANN Model - Accuracy

Table 4. Error And R-Square Of The Developed ANN Model In Prediction Of The Outcome Of New Input Data

Table 5. Error And R-Square Of The Developed ANN Model In Prediction Of The Outcome Of New Input Data

CONCLUSIONS

• The water wettability and corrosion resistance of primary and secondary AlSi10MnMg(Fe) alloys were studied as a function of the physical and chemical properties of the surface.
• Artificial Neural Network - to map the input data (alloy type, droplet size, section size) to the output (CA).
• Developed ANN model – able to predict unseen CA values with high accuracy (r = 0.96).
• Topographical and microscopy images - Large intermetallic phase fraction = higher heterogeneity = high surface roughness = greater CA values
• Corrosion Studies - primary alloy is more corrosion resistant than the secondary alloy due to the less galvanic sites. Additionally, increasing surface roughness = reduced corrosion resistance.
• These findings can be used as a guide to design and optimize surface composition, structure and roughness to improve corrosion resistance of cast secondary aluminum alloys.

References

[Insert references related to the content of the document]