The present work aims to investigate the corrosion resistance of the Mg-Al-Mn alloys based on thermodynamic calculations. Scheil solidification simulation was used to design the target alloys. Based on the calculated results, five as-cast alloys were prepared and their phase composition were analyzed. The corrosion behaviors of these alloys were then characterized in the 3.5 wt.% NaCl solution. The results of electrochemical tests demonstrated that the passivation existed in alloys 0# to 2# and the alloy 2# has the best corrosion resistance.

2. Alloys design

2.1 Al content

2.2 Mn content

2.3 Phase composition obtained from calculation

According to the calculated results, the nominal composition of the alloys were finally designed to Mg-10Al-xMn (x = 0, 0.3, 0.6, 0.9, 1.2)

3. Experimental result

3.1 Phase composition analysis

Phase composition determined by electron probe microanalysis (EPMA) and X-ray diffraction (XRD) were corresponded with the calculated results.

3.3 Electrochemical tests

The results of electrochemical tests demonstrated that the passivation existed in alloys 0# to 2# and the alloy 2# has the best corrosion resistance.

3.4 Corrosion products

Corrosion products: MgO, Mg(OH)₂, MgCO₃, Al₂O₃, Al(OH)₃ and MnO₂

3.5 Gibbs energy of the LTA₈M₅n₈ phase

In alloy 2#, The Gibbs energy of the LTA₈M₅n₈ was the most positive and the difference between (Mg) and LTA₈M₅n₈ was the smallest.

4. Conclusion

- CALPHAD method was used to design the nominal composition of the alloys and clarified the corroded phenomenon reasonably;
- The results of corrosion tests demonstrated that the alloy 2# has the best corrosion resistance.

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