

Role of Zinc under corrosion environment for Magnesium alloy of super plastic processing

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Introduction

Magnesium (Mg) alloy is advanced material for light weight applications. Though there has been shown the difficulty problems in mechanical processing, in recently, application of super plastic processing for Mg alloy make it easy to produce the parts and then, the super plastic process is to provide a wide range of application. Also, the addition of the Zinc into Mg alloy gives a good balance of strength and toughness.

However, the corrosion resistance of Zn addition alloys(ZK) is lower than Al addition alloys(AZ), and it can be found that the corrosion behavior in Mg alloy which were conducted to use super plastic processing have shown the same trend of extrusion and rolling works. To understand of the corrosion behavior and to process of high corrosion alloy using super plastic processing, the role of Zn under corrosion environment is important. The central point of this research is to investigate the trend of Zn into Magnesium alloy with comparison to AZ and ZK which were produced by super plastic process and extrusions, and to determine the Zn compound included in the corrosion product using by XAFS.

Experiment

Test specimens in this test were two kind of Mg alloys which were processed by super plastic process and extrusion, respectively. Also the corrosion material in ZK alloy was used in this test. Corrosion test were conducted by water proof test. To investigation of corrosion condition, the microstructure and chemical composition were performed by Scanning Electron Microscope (SEM) and EDS. By characterize of EDS, it was found that the corrosion product were generated by reaction with Zn. In this study, in order to investigate the local structure of Zn, we measured the corrosion product by XAFS measurements.

Results

Figure 1 (a) and (b) show Zn K-edge XANES spectra of AZ, ZK alloys, the corrosion product of ZK alloy and Zn foil. The XANES spectra were very similar in these Mg alloys. Therefore, the local structure and the electronic state of Zn in these Mg alloys are almost same one another. The electronic state of Zn is not influenced by super plastic processing. XANES spectrum of the corrosion product of ZK alloy is different from the one of Zn foil. This means that the local structure of Zn is different from that in Zn metal. In near future, we will perform further experiments to make clear the local structure of Zn compound in the corrosion product of ZK alloy.

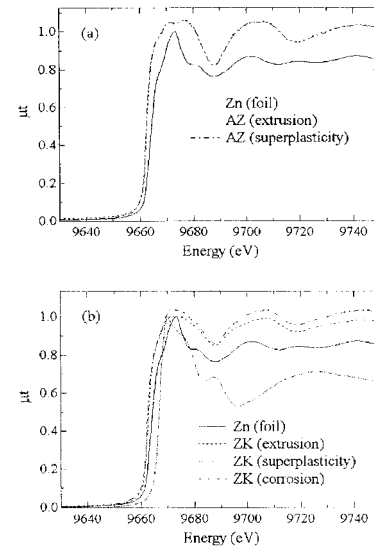


Fig. 1 Zn K-edge XANES spectra of AZ, ZK alloys, the corrosion product of ZK alloy and Zn foil.

Valences of doped atoms at 6c site in Si and Ge clathrates

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Silicon or Germanium clathrates have crystalline structure formed with cage-like cluster. From the discovery of superconducting clathrate Ba₈Si₄₆, Si and Ge clathrates have been intensively studied. It is considered that endhedral Ba atoms in Si cages dope conduction electrons. However, newly synthesized metallic clathrates containing transition metals such as Ba₈T_xSi_{46-x} (T=Au, Ag and Cu) are not superconducting. One candidate of breaking superconductivity in transition metal doped clathrates is decreasing conduction electron by doped transition metals behaving as acceptors.

In the case that doped metal behaves as acceptor, dopant has minus valence. Thus, we performed transmission XAFS measurement to determine valences of doped Cu, Ag and Au in Ba₈Cu₆Si₄₀, Ba₈Cu₆Ge₄₀, Ba₈Ag₆Ge₄₀ and Ba₈Au₆Ge₄₀. Foils of Au, Ag and Cu and Au₂S, Au₂O₃, AgCl, Cu₂O and CuO were also observed as references. Chemical shifts K absorption edge of Ag was observed with using monochromatized beam by Si(511) reflection. Net plane of double-crystal Si

monochrometer used to observe K absorption edge of Cu and L_{III} absorption edge of Au was (111) to obtain high energy resolution.

There was no detectable difference of Ag K-absorption energies among Ba₈Ag₆Si₄₆, AgCl and Ag foil. Discrepancy of Au valence among Au foil, Au₂S and Ba₈Au₆Si₄₆ was also not detected. However, the figure indicates that K-absorption energies of doped Cu in the observed Si and Ge clathrates (indicated by ◊ and ○ respectively) are nearly the same as Cu₂O. Thus, it is concluded that valences of doped Cu in clathrates are near to +1.

