Electrochemical properties of electrochemical co-precipitated Mg-Al Layered Double Hydroxides

Yusuke OKAMOTO, Yuya KITAGUCHI, Eiko MIEDA, Hirohisa YAMADA and Katsumi KATAKURA
Department of chemical Engineering, National Institute of Technology, Nara College
22 Yata-cho, Yamatokoriyama, Nara 639-1080, Japan

yamada@chem.nara-k.ac.jp

Introduction

Layered Double Hydroxides (LDH) is well known as anionic clays of positively charged metal hydroxide layers with anion species in the interlayer. The LDHs have interesting properties originate from the charge compensation of the cationic layers. We reported that Mn-Al LDHs can be electrochemically co-precipitated on electrode surface.[1)] Tatsumisago *et. al*. reported that Mg-Al LDH have high performance as the electrolyte for Direct Ethanol Fuel Cells.[2)] In this study, we synthesized Mg-Al LDHs by electrochemical co-precipitation and evaluated their characteristic properties.

Experimental

The LDH was synthesized by electrochemical co-precipitation method. Pt sheet was used as a working electrode and immersed in aqueous solution containing 0.075 mol dm^{-3} $Mg(NO_3)_2$ + 0.025 mol dm^{-3} $Al(NO_3)_3$ under Ar atmosphere. Galvanostatic electrolysis was carried out at -8, -16, -32 and -64 mA cm^{-2} for 10 min.

Results and discussion

Fig. 1 shows XRD patterns of electrochemically co-precipitated thin films on the Pt electrode at each current density. Characteristic peaks 11^o (003) and 22^o (006) in LDH were observed on each samples, therefore Mg-Al LDH is successfully synthesized by electrochemical method. Fig. 2 shows SEM images on the electrochemical co-precipitated Mg-Al LDH. A fine LDH film coated on the Pt electrode surface was observed, and the surface morphology was changed by current density. Ion conductivities of Mg-Al LDHs at 80^oC under RH = 80% were shown in Fig. 3. The sample prepared at -8 mA cm^{-2} has a highest conductivity, and they were smaller with increasing current densities. Therefore, the morphology and composition would be affected the ion conductivities of the electrochemically co-precipitated LDH thin films.

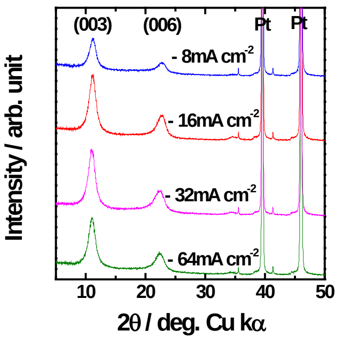

Fig. 1 XRD patterns of electrochemical prepared samples.

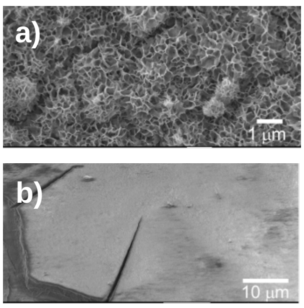

Fig. 2 SEM images on electrochemical coprecipitated method. (a) -8 and (b) -64 mA cm^{-2}.

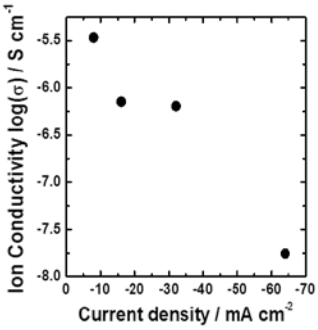

Fig. 3 Ion conductivities of LDH at 60^oC under 80%RH.

Reference

1) Chihiro OBAYASHI, Mituru ISHIZAKA, Takayoshi KONISHI, Hirohisa YAMADA, and Katsumi KATAKURA, *Electrochemistry*, **80(11)** (2012) 1-4.

2) Yoshihiro FURUKAWA, Kiyoharu TADANAGA, Akitoshi HAYASHI, and Masahiro TATSUMISAGO, *Solid State Ionics*, **192** (2011) 185-187.