Radio-Frequency Magnetron Sputtering Power Effect on the Ionic Conductivities of ZrO_2 Films

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Solid electrolytes have several advantages over liquid electrolytes, such as no leakage problem, broad operating range, excellent charge-discharge cyclic properties due to a lack of side reactions occurring and only one type of carrier ion migration, and long life because of little self-discharge. Such solid electrolytes should have properties such as a very high ionic conductivity, negligible electronic conductivity, and very low activation energy.

Zirconia (ZrO_2) electrolyte films were grown on Pt / Ti / SiO_2 / Si substrate by means of a radio-frequency reactive sputtering system using 4"Zr (99.99% Nuricell. Com) targets, respectively. Prior to the deposition of the electrolyte films, the Ti adhesive layer and Pt current collector films were deposited by using dc magnetron sputtering system. Subsequently, ZrO2 electrolyte films were deposited on Pt at a radio-frequency power of 200W. The characteristic of electrolyte was examined by scanning electron microscopy (SEM: HITACHI, S-4100) – **Figure1**, atomic force microscope (AFM: PSIA), x-ray diffraction (XRD Rigaku, 20B diffractometer with CuK_α radiation), and Rutherford backscattering spectroscopy (RBS, NEC 6SDH-2) - **Figure2**.

To measure the ionic conductivity in the ZrO_2 electrolyte films, impedance were measured by IM6 (Zahner Elektrik) with a structure of Pt /electrolyte/Pt/Ti/SiO_2/Si.

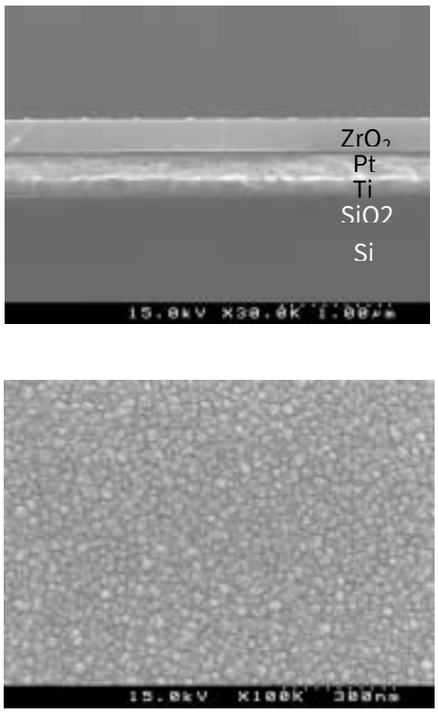

Figure 1. SEM images of the ZrO_2 electrolyte film

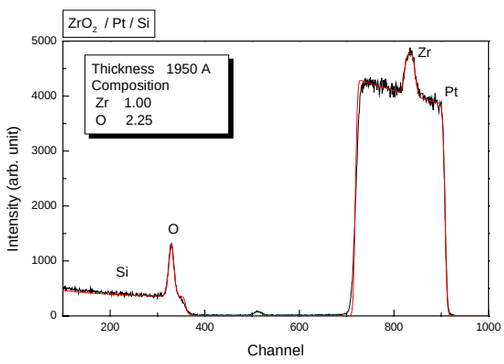

Figure 2. RBS data of the ZrO_2 electrolyte film

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