

INVESTIGATION OF CATHODIC REACTION IN SOFCs AND PCFCs BY USING PATTERNED THIN FILM MODEL ELECTRODES

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In recent years, fuel cells operating at relatively high temperatures, such as solid oxide fuel cells (SOFCs) using an oxide ion conducting electrolyte and proton ceramics fuel cells (PCFCs) using an proton conducting electrolyte, attract attentions as high-efficient energy-conversion devices. For further enhancements of the performance and the durability of SCFCs and PCFCs, it is essential to understand the electrode reactions. In particular, the knowledge on the dominant reaction path in the electrodes would help us to optimize the material and the microstructure of the electrode.

As cathodes for SOFCs and PCFCs, perovskite or perovskite-related oxides containing 3d transition metals are typically used. However, the cathodic reactions on these oxide electrodes are not fully understood. In this work, cathodic reactions on such oxide cathodes were investigated by using patterned thin film model electrodes.

In the case of a practical porous electrode, its complicated microstructures often make the precise investigation on the electrode reactions very difficult. In this work, for the detailed evaluation of the electrode reaction in SOFCs and PCFCs, we proposed to use patterned thin film electrodes as model electrodes. The schematic illustrations of the proposed model electrodes are presented in Fig.1. The patterned thin film electrodes are kinds of a columnar electrode simplifying the microstructures of a porous electrode. We fabricated patterned thin film electrodes with or without TPBs, as shown in Fig. 1(A) and (B), respectively, by helps of lithography and pulsed laser deposition techniques. By applying these model electrodes, we can expect to examine the electrode reaction while ignoring the influence of the microstructures. In the presentation, the cathodic reactions in SOFCs and PCFCs will be discussed based on the results of electrochemical and spectroscopic measurements with the proposed model electrodes.

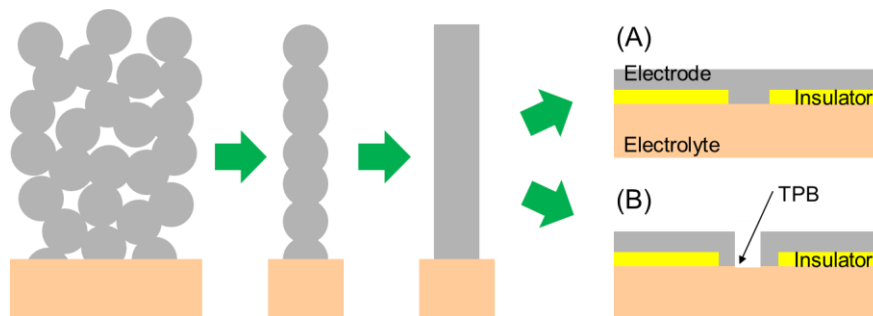


Fig. 1. Schematic illustration of the patterned thin film electrodes: (A) without and (B) with triple phase boundary