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Fabricating macroporous RuO_2–TiO_2 electrodes using polystyrene templates for high chlorine evolution efficiencies

Tran Le Luu[a], Choonsoo Kim[b], Seonghwan Kim[b], Jiye Kim[b], Jeyong Yoon[b,*]

[a]*Department of Mechatronics and Sensor Systems Technology, Vietnamese German University, Le Lai Street, Hoa Phu Ward, Thu Dau Mot City, Binh Duong Province, Vietnam*
[b]*School of Chemical and Biological Engineering, Institute of Chemical Process (ICP), Asian Institute for Energy, Environment & Sustainability (AIEES), Seoul National University, Gwanakgu, Daehak-dong, Seoul 151-742, Korea, Tel. +82-2-880-8941; Fax: +82-2-876-8911; email: jeyong@snu.ac.kr (J. Yoon)*

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ABSTRACT

In dimensionally stable anodes, RuO_2–TiO_2 has emerged as one of the fundamental anode materials in terms of practical application because of its high stability and catalytic performance toward chlorine evolution. Nevertheless, high chlorine evolution efficiency is still required for an effective chlorine production process. In this study, high chlorine electrocatalytic active RuO_2–TiO_2 electrodes were fabricated using several ranges of polystyrene microsphere templates (0.1, 0.46 and 1.1 μm) resulting in novel three-dimensional ordered macroporous structures. Higher chlorine evolution efficiency was observed in the macroporous RuO_2–TiO_2 electrodes than that in the nontemplated electrode at the same Ru loadings. In particular, a macroporous electrode fabricated with a specific polystyrene size (0.46 μm) exhibited the highest chlorine evolution efficiency in this study indicating the existence of an optimal macropore size for RuO_2–TiO_2 electrodes in the chlorine evolution reaction. This chlorine evolution efficiency could be attributed to the well-developed outer active surface area formed by the optimal pore structure which contributes to the easy mass transfer of chloride ions and removal of produced chlorine gas bubbles. This novel idea strategically provides a new method for preparing inexpensive RuO_2–TiO_2 electrocatalysts with a high electrochemically active surface area, especially the outer active surface area for chlorine evolution.

Keywords: DSA; RuO_2–TiO_2; Macroporous; Chlorine evolution; Outer surface area

* Corresponding author.