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Chelating-assisted soft-templating synthesis of ordered mesoporous TM-doped TiO_2 for enhanced catalytic oxygen evolution

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The fabrication of highly active, robust and cost-effective catalyst with earth abundant elements for efficient electrochemical splitting of water to hydrogen and oxygen is of essential significance for clean and sustainable energy conversion and storage systems. In this study, we present a controllable and reliable method for the doping of mesoporous TiO_2 with appropriate transition metal (TM) dopants for an efficient electrocatalytic oxygen evolution reaction (OER). The ordered mesoporous TM-TiO_2 with uniform large mesopores and a crystalline framework is successfully synthesized through a chelating assisted soft-template strategy using amphiphilic triblock copolymer Pluronic F127 (PEO106PPO70PEO106) as a structure directing agent. Compared to the pure TiO_2 mesoporous, the TM-doped TiO_2 mesoporous exhibit greatly enhanced OER activity. Furthermore, the TM dopant concentration significantly affects the oxygen evolution reaction (OER) activity of TM-TiO_2 mesoporous, and the Co-TiO_2 with very low wt% show the highest OER activity with a 0.286 V reduction of the overpotential with respect to undoped TiO_2 mesoporous, and higher mass activity 4460 mA mg-1 , higher specific activity 2 mA cm-2, indicating that TM substitutions on mesoporous TiO_2 crystal are able to alter the adsorption energy of reaction intermediates for OER in spite of the low quantity of dopant.

Biography

Mabrook S Amer obtained his undergraduate degree in Chemical Physics from Thamar University in the year 2005. Then he completed his MSc degree in Electrochemistry at King Saud University in 2013. His MSc thesis was devoted to the Development of a heteropolyanion modified carbon electrode for cyclohexane electrocatalytic oxidation. Currently, he is working as a Researcher in Electrochemistry Research group (ERG) at King Saud University. His present research interests are synthesis, characterization and application, of nanostructured materials modification, assembly, construction of highly ordered semiconductors mesoporous materials for electrochemical and photoelectrochemical hydrogen production and energy storage and conversion.

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