Graphene and Carbon Nanotube Composite Conducting Scaffold in Iron Oxide Photoanode for Photoelectrochemical Water Oxidation

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In this study, graphene was hired as part of composite conducting scaffold together with carbon nanotube (CNT) in iron oxide photoanode for photoelectrochemical (PEC) water oxidation. We already studied pure CNT conducting scaffold for improving electrical conductivity of iron oxide photoanode before. Of course pure CNT conducting scaffold was demonstrated effective at charge transfer and separation but we expect CNT and graphene composite conducting scaffold plays better roles in iron oxide photoanode due to synergistic structural effect of these two carbon materials. 1-dimension (CNT) and 2-dimension (graphene) mixed structure will produce more pores enlarging surface area contacted to iron oxide particles so that photoexcited electrons have more chances to transfer to substrate through this composite conducting scaffold. CNT and graphene composite conducting scaffold was demonstrated to enhance photoelectrochemical water oxidation activity of iron oxide photoanode much more than pure CNT and even pure graphene. Exact roles of composite conducting scaffold were elucidated using electrochemical impedance spectroscopy (EIS).