Insights into the BaTiO₃-Pb Perovskite Semiconducting Layer in PbO₂ Electrode Preparation by Electrochemical Deposition and Its Performance Evaluation

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PbO₂ electrode has high water splitting potential as that of BDD electrode, but no stability was shown in electrochemically deposited PbO₂ electrode. In this work, the effect of lower layer (a perovskite type dielectric BaTiO₃) on PbO₂ electrodeposition and its electrochemical performance evaluation was enrooted. BaTiO₃ was deposited on pretreated Ti in highly basic 4 M KOH medium resulted in needle shaped BaTiO₃ crystals of length 4.79 μm and width 0.43 μm. Co-deposition with nano-PbO₂ (BaTiO₃-NPb) and Pb(NO₃)₂ (BaTiO₃-Pb) produced a flower- and fur tree-like structures, respectively. Further, the upper layer of PbO₂ deposited in acid medium on BaTiO₃-NPb and BaTiO₃-Pb completely changed the shape to cauliflower-like shapes and cauliflower-like shapes with rock-like shapes, respectively. XRD result demonstrated the BaTiO₃ structure orientation was influenced to achieve mostly β-PbO₂ orientation. Electrochemical impedance and cyclic voltammetry analyses of BaTiO₃-NPb/PbO₂ and BaTiO₃-Pb/PbO₂ electrodes demonstrated smooth and porous morphological surfaces, respectively. When BaTiO₃-NPb/PbO₂ electrode was applied as an anode for the direct oxidation of phenol, it was found a considerable impact on its catalytic activity. An accelerated stability test result demonstrated BaTiO₃-NPb/PbO₂ is stable for more than 3000 h in H₂SO₄ medium.

Keywords: BaTiO₃, Morphological Change, Co-deposition, PbO₂.

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