Simultaneous Ozone and Hydrogen Peroxide Electrosynthesis via Defect Modulation in Ni, Sb-doped SnO_2 Electrocatalysts

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August 24, 2023

Abstract

Electrochemical synthesis of green oxidants O_3 and H_2O_2 is valuable for applications, but challenges persist in enhancing the O_3 and H_2O_2 generation activity and combined application. Herein, we modulate the surface Ni active sites and oxygen vacancy defects content in Ni-Sb-SnO_2 electrocatalysts to enhance selectivity for electrochemical ozone generation (EOP) and two-electron electrochemical oxygen reduction reactions (2e- ORR). The Ni active sites and oxygen vacancy defects enriched electrocatalysts resulting in an ozone faradaic efficiency of 48.1%, while non-enriched electrocatalyst obtained 90% selectivity for H_2O_2. Theoretical calculations revealed that Ni-Sb-SnO_2 efficiently captures O_2 with defective O_{vac2} stabilize intermediates, facilitating O_3 and H_2O_2 synthesis. Moreover, concerted EOP and 2e- ORR enable concurrent generation of O_3 and H_2O_2 for efficient synergistic degradation of organic pollutants, while attenuating the energy demands of the electrolyzer. This study provides an appealing strategy for the simultaneous production of O_3 and H_2O_2 with applications in wastewater treatment.

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