

Boosting electrocatalytic oxidation of heterocyclic alcohols with low usage aminoxyl radicals via MOF-derived NiOOH

Jian-guo Wang¹, Kai Li¹, Linhan Ren¹, Suiqin Li¹, LiHao Liu¹, Jiahui He¹, Yinjie Xu¹, Mengxin Wang¹, Shuying Zhao¹, Yuhang Wang¹, Ying Chen¹, Jieyu Wang¹, and Xing Zhong¹

¹Zhejiang University of Technology College of Chemical Engineering

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Abstract

Aminoxyl-mediated electrocatalysis offers a sustainable approach for the oxidation of alcohols to carboxylic acids. However, the high dosage of aminoxyl radicals and the limiting current density hinder the practicality of industrial application. Herein, a nickel-based electrocatalyst (Ni-tpdc) was synthesized on a three-dimensional porous graphite felt substrate. Taking advantage of the synergistic effect of the electrochemically activated Ni-tpdc/GF electrocatalyst with 4-acetamido-TEMPO, the yield of 4-pyridinecarboxylic acid was up to 99% with only 1 mol% ACT. A series of in situ measurements showed that NiOOH enhanced the activity of the intrinsic electrocatalyst. Additionally, the synergistic system was extended to the oxidation of various heterocyclic alcohols. The scale-up synthesis of chiral acid (LEV-CO₂H) was achieved in an improved electrolyzer with a yield of 95.4%, enantiomeric retention of 99.2%, and space-time yield of 34.12 kg/(m³·h). The practicality and effectiveness of this synergistic electrocatalytic strategy in practical electrosynthesis was further demonstrated.

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