

Screening of Transition Metal Oxides for Electrocatalytic Nitrate Reduction to Ammonia at High Currents

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Abstract

Electrochemical nitrate reduction reaction (NtrRR) towards ammonia, as an emerging and appealing technology alternative to the energy-intensive Haber-Bosch process and inefficient nitrogen reduction reaction, has recently aroused wide concern and research. However, the current research of the NtrRR towards ammonia lacks the overall performance comparison of various electrocatalysts. Given this, we here make a comparison of 12 common transition metal oxide catalysts for the NtrRR under a high cathodic current density of 0.25 A cm⁻², wherein Co₃O₄ catalyst displays the best NtrRR selectivity towards ammonia with a highest Faradaic efficiency (85.15%) and a moderate NtrRR activity. Other external factors, such as nitrate concentrations in the electrolyte and applied potential ranges, have also been specifically investigated for the NtrRR. This work can provide constructive guidance to engineer the NtrRR electrocatalysts with higher activity, selectivity and stability in the future.

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