Enhancing Sulfur Resistance of Oxides in Catalytic Oxidation by a High Entropy-Stabilized Strategy

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Abstract

Industrial chemical processes require sulfur-resistant catalysts, which reduce catalyst replacement costs and simplify process operations. Herein, a high-entropy-stabilized strategy was put forward for sulfur-resistant catalysis. A high entropy (Zn₂Mg₂Cu₂Mn₂Co₂Al₂O₄) showed stable performance in CO oxidation with SO₂, while unitary oxide and binary spinel oxide were all deactivated. The mechanism study showed that the adsorption of SO₂ onto Zn₂Mg₂Cu₂Mn₂Co₂Al₂O₄ was challenging. Moreover, Zn₂Mg₂Cu₂Mn₂Co₂Al₂O₄ has a high degree of disorder, with five metal elements co-temporarily living in one cell location as cations. Thermodynamic equilibrium allows the sacrificial cations to capture the trace SO₂ anchor on the Zn₂Mg₂Cu₂Mn₂Co₂Al₂O₄ surface in time to protect the catalytically active cation. This work reveals the significance of high-entropy structures in sulfur resistance and offers a novel design strategy for sulfur-resistant catalysts.

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