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Single-atom Catalysis towards Efficient CO2 Conversion

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PURPOSE OF THE ABSTRACT
Single-atom catalysis has become one of the new frontiers in heterogeneous catalysis since this concept was first proposed in 2011.1,2 With the rapid developments of practical preparation techniques, characterizations and computational modeling approaches, a huge number of single-atom catalysts (SACs) with distinctive performances for various reactions, from thermo-chemical reactions to electro-chemical and photo-chemical reactions, have been reported in the past few years.3 As a specific example, SACs have exhibited distinctive performances in CO2 chemical conversions. The unique structures of SACs are appealing for adsorptive activation of CO2 molecules, transfer of intermediates from support to active metal sites, and production of desirable products in CO2 conversion.4,5 In this talk, I will exemplify our recent endeavors in the development of SACs toward CO2 conversions in electro-catalysis. We prepared heteroatom-doped carbon anchored Ni-SAC, which exhibited high activity (TOF 14,800 h-1 at an overpotential of 0.61 V), selectivity (97% faradaic efficiency for CO) and stability (only 2% loss of activity after 100 h electrolysis).6 With a set of high-resolution, spectroscopic and in-situ technique characterizations, we disclose the details about the structural geometry of these SACs, and tentatively shed light on how these catalysts work for CO2 transformation. The concept of single-atom catalysis may even help realize the ultimate goal of transforming CO2 into valuable products by using heterogeneous catalysts at mild conditions.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Single-atom catalysis | heterogeneous catalysis | carbon dioxide conversion

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