Atomic-Scale Observation of Adsorption, Activation and Dissociation of CO_2/CO on Single-Atom Catalyst Using STM and Nc-AFM

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The dissociation of CO_2 and CO is a critical step in numerous industrial processes, holding significant application value in the fields of energy and industrial catalysis. Recently, we have synthesized a series of regular metal single-atom[1] and dual-atom[2] catalysts on copper oxide substrates, some of which exhibit superior catalytic dissociation capabilities for CO_2 and CO.

In this study, we present the synthesis of some above-mentioned supported single-atom catalysts (such as Pd_1 in ***Fig 1.***) on monolayer CuO and their application in CO_2/CO dissociation reaction. Through advanced characterization techniques, including Scanning Tunneling Microscopy (STM) and non-contact Atomic Force Microscopy (nc-AFM), we could elucidate the adsorption and reaction dynamics of CO_2/CO on the single-atom sites, providing comprehensive insights into the atomic-level mechanisms during the adsorption, activation, and dissociation process. What's more, through the performance comparison of different charged Pd single atoms, it could also offers novel insights into the mechanisms of CO_2/CO related catalytic reactions.

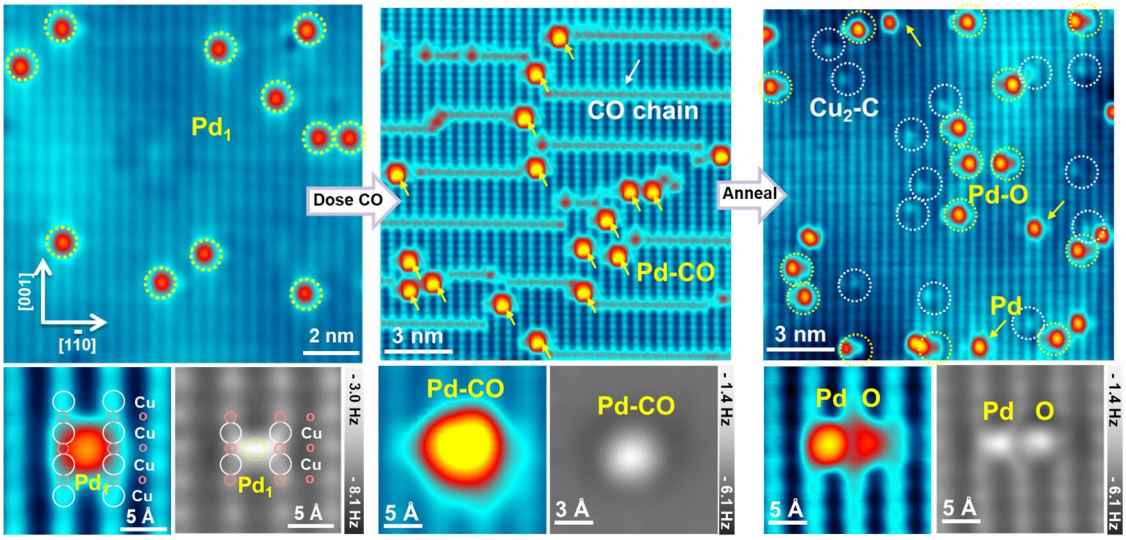

Figure 1. CO dissociation process on Pd_1/CuO single-atom catalyst.

Reference

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[2] Pan, J.; Li, X.; Zhu, Y.; Zhou, J.; Zhu, Z.; Li, C.; Liu, X.; Liang, X.; Yang, Z.; Chen, Q.; Ren, P.; Wen, X.; Zhou, X.; Wu, K. J. Am. Chem. Soc. **145**, 18748 (2023).