Preparation of high loading Pd-CHA by dispersion of bulk Pd and its NO adsorption/desorption property

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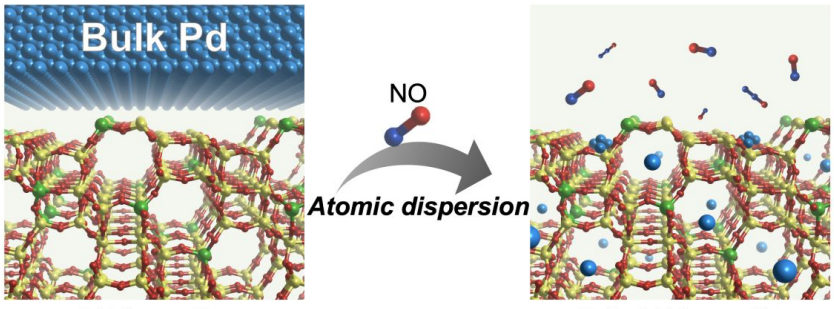
Passive NOx adsorber (PNA) is a promising approach to reduce NOx emission from vehicle engines during a cold-start period (< 200 ˚C) where NOx are trapped at low temperatures and then released at the operating temperature for selective catalytic reduction system (e.g. NH_3-SCR system). Pd-loaded CHA zeolites (Pd-CHA) have recently attracted attention as promising PNAs because of the great hydrothermal stability of CHA zeolite framework and NO adsorption ability of loaded Pd^{2+} cations. However, the preparation of high-loading Pd-CHA is still difficult by a conventional aqueous ion-exchange method due to the strong water solvation of cations, which are too bulky to access the small pores of CHA zeolite.[1)]

In this study, we achieved the preparation of high-loading Pd-CHA based on NO-facilitated atomic dispersion of bulk Pd.[2)] Under a 4% NO flow at 600℃, bulk metal Pd (particle sizes in the 50-100 nm range) outside CHA zeolites effectively disperses, affording Pd^{2+} cations on paired Al sites with concomitant formation of N_2O. The highest Pd loading amount (Pd: 4.1 wt%) was achieved among the previously reported methods. In the NO adsorption/desorption experiment, the desorption temperature for the Pd-CHA with higher loading was higher compared to the one with lower loading (Pd: 0.5 wt%). DFT calculations revealed that the strength of NO adsorption on Pd^{2+} cations depend on the local structure of surrounding paired Al sites.



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