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Manufacturing of Dispersed Pt1/Fe2O3 and Pt1/CeO2 Catalysts for CO Oxidation at Elevated Temperatures

Background

Noble metal-based catalysts have been widely utilized as emission control catalysts. However, most of the noble metal-based catalysts used in heterogeneous catalysis have a low atom efficiency since their dispersion is much less than 100%, especially for larger nanoparticles. This significantly increases the usage of noble metal in order to meet the required catalytic performance and unavoidably increases the cost of supported noble metal catalysts.

Invention Description

Researchers at Arizona State University have developed atomically dispersed Pt1/Fe2O3 and Pt1/CeO2 catalysts for CO oxidation at elevated temperatures, at or higher than 350 °C. The Pt1 turnover frequency (TOF) and the specific reaction rate of the Pt1/Fe2O3 catalyst are >100 times and >180 times higher than those of the nano-Pt/Fe2O3 (Pt particles), respectively. Such an advancement of active and stable Pt1/Fe2O3 and Pt1/CeO2 single-atom catalysts (SACs) may replace the conventional Pt nanoparticles as active components to prepare more efficient and cost-effective three-way catalysts for automotive emission control. The atomically dispersed catalysts were synthesized via a scalable adsorption method by finely tuning the wet chemistry processing parameters such as solution pH value, treatment of support materials, volume ratio of H2O, solution temperature, and the degree of mixing.

Potential Applications

- Automotive or stationary emission control catalysts

Benefits and Advantages

- Reduces usage of expensive Pt in emission control applications
- Extremely high CO oxidation rate at moderate temperatures (>350 °C)

- Ready and facile implementation in existing processes