J Ind Environ Chem 2019, Volume 3
DOI: 10.4066/2591-7331-C1-009

AuPd/3DOM CeO_2 catalysts with good chlorine-resistant performance and catalytic stability in trichloroethylene combustion

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Chlorinated volatile organic compounds (CVOCs) are harmful to the atmosphere and human health. Catalytic oxidation is a good promising method for the removal of CVOCs and the development of high-performance catalysts is the key issue. In this work, the high-efficiency three dimensionally ordered macro-porous (3DOM) CeO_2-supported AuPd alloys (xAuPdy/3DOM CeO_2; x = 0.46–2.85 wt.%, y = 1.85–1.89) catalysts were prepared using the polymethyl methacrylate templating and polyvinyl alcohol protected reduction methods. Physicochemical properties of the samples were characterized by means of various techniques, and their catalytic activities for trichloroethylene (TCE) combustion (reaction condition: 750 ppm TCE + 20 vol% O_2 + N_2 (balance) and space velocity was 20,000 mL/(g h)) were evaluated. It is found that the catalysts possessed a good-quality 3DOM structure and the noble metal nanoparticles (NPs) with a size of 3–4 nm were uniformly dispersed on the surface of 3DOM CeO_2. The 2.85AuPd1.87/3DOM CeO_2 sample showed the highest catalytic activity with a T90% (the temperature required for achieving a conversion of 90%) of 415°C and this sample also possessed excellent catalytic stability and moisture-resistant ability. Based on the characterization results and activity data, we conclude that the excellent catalytic performance of 2.85AuPd1.87/3DOM CeO_2 was associated with its high adsorbed oxygen species concentration, good low-temperature reducibility, and strong interaction between AuPd nanoparticles and 3DOM CeO_2.

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