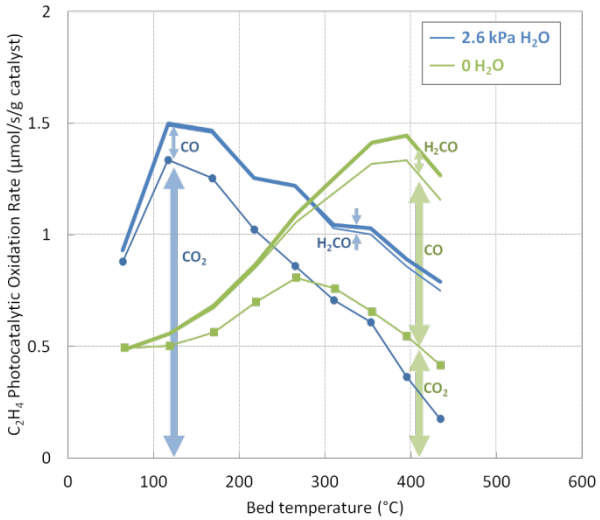
Photocatalysis, where solar energy provides activation energy can in principle contribute to offsetting some of the demand on fossil fuels compared to conventional catalysis. Major efficiency improvements are still needed, however, before photocatalysis becomes a practical and economically viable technology (1). Previous work has shown that photoactivity occurs and even increases at high temperatures (2). This work investigates two new photocatalysis phenomena that potentially occur at high temperature with the deposition of Au nanoparticles on the surface of TiO_2. Both phenomena involve the migration of photo-generated electrons to the unfilled bands of deposited Au nanoparticles according to a well-known mechanism (3). First, this decreases the rate of electron-hole recombination in TiO_2, which could increase its photocatalytic activity at high temperature. Second, this could cause an electrochemical promotion of the Au catalytic activity. The photoactivities of TiO_2 and Au/TiO_2 catalysts prepared by flame-spray pyrolysis and photodeposition were evaluated by C_2H_4 oxidation experiments in a novel quartz plate reactor and in in-situ DRIFTS experiments. Results showed no photocatalytic promotion of Au, likely due to its relatively large average particle size of 11.6 nm, measured by STEM. However, a new photocatalytic reaction pathway was discovered on TiO_2 alone which had a maximum rate near 400°C, and which was enhanced by Au nanoparticles in the presence of H_2O. This new pathway may represent an exciting new type of photocatalysis, accessible at high temperature, and inspires future research to understand what other reactions may be catalyzed by its chemistry.



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