571e Development of a Viable Reaction Mechanism for the Epoxidation of Propylene over Au/Ts-1

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The gas-phase epoxidation of propylene over Au/Ti catalysts using a mixture of oxygen and hydrogen represents an environmentally benign method for the production of an important chemical intermediate with applications ranging from food additives to block copolymers. Catalysts prepared by depositing gold onto titanium containing supports have traditionally suffered from low rates and rapid deactivation. The development and application of micro and mesoporous titanosilicates as support materials has significantly increased propylene oxide production rate, though on-stream stability is often poor. As a result, there is little kinetic information on this system. The use of titanium silicalite-1 (TS-1), an MFI-type zeolite consisting of titanium highly dispersed in a silica matrix, as the support material represents a viable method of obtaining stable kinetics. The high production rates of Au/TS-1 catalysts (>100 $g_{PO}/hr/kg_{cat}$), coupled with considerable on-stream stability (> 45 hours), has allowed for the first comprehensive kinetic analysis of this system in the absence of deactivation. In order to fully exploit the stability of these materials, a factorial design of experiments has been utilized to maximize the information content of the experiments. This approach has aided the proposal and validation of elementary reaction steps, resulting in a comprehensive 2-site reaction mechanism for the selective oxidation of propylene to propylene oxide.