Oxidation of Toluene Over Copper Catalysts Promoted by Molybdenum and Tungsten Oxides

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Oxidation of toluene was studied over copper catalysts promoted by oxides of molybdenum and tungsten. The CH_3 groups are oxidized to benzaldehyde, the final product. The kinetics of oxidation of toluene, propylene, piperylene, and isoprene are shown to be closely similar. This similarity is explained as due to near-identical energy requirements to rupture the C—H bonds of the methyl- and the double-bonded groups which are attached to the benzene rings.

Kinetics of Oxidation of Isobutylene to Methylacrolein Over a Copper Catalyst

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A mechanism is proposed for oxidation of isobutylene. The kinetic equations, based on this mechanism, for the rates of formation of methylacrolein and carbon dioxide are in good agreement with the empirically-determined equations, as follows:

$$W_1 = \frac{k_1 \times C_{O_2} \times C_{C_4H_8}^{0.1}}{1 + b_1(C_{C_4H_6O} + C_{H_2O})}$$

$$\text{and} \quad W_2 = \frac{k_2 \times C_{O_2}^{0.8}}{1 + b_2 \times C_{H_2O}}$$

The heats of activation of methylacrolein and CO_2 formation at the usual operating conditions are $E_1 = 14$ and $E_2 = 23$ kcal/mol, respectively; in absence of the process-retarding by-products, the respective heats of activation are $E_1 = 15$ and $E_2 = 20$ kcal/mol.

A comparison of basic kinetic correlations is given for oxidation of isobutylene and propylene over a copper catalyst.

Investigation of Adsorption of Hydrogen and Carbon Monoxide on a Nickel Catalyst

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Adsorption by a nickel catalyst of carbon monoxide and hydrogen gases—individually and as mixtures—was investigated at 75°, using volumetric and gravimetric analytical techniques. These adsorption conditions duplicated those directly preceding the initiation of CO hydrogenation. The experimental data for adsorption of carbon monoxide are interpreted to show the presence of three types of bonds between the adsorbed gas molecules and the nickel catalyst surface.