impurities. It was also established that pure silver has approximately the same activity, regardless of the method of its preparation.

### Kinetics of Catalytic Oxidation of Ethylene

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A study was made of the kinetics of oxidation of ethylene over a silver catalyst into ethylene oxide and into carbon dioxide and water, using a recycle-continuous process. A detailed study was made of the retarding effect of the reaction products. Based on a concept of the mechanism of this catalytic process, new kinetic equations were developed which satisfactorily agree with the experimental data for a wide range of changes in the concentrations of charge stocks and of reaction products. The kinetic equations developed are also in agreement with the results obtained by other investigators.

### Oxidation of Ethylene in a Pseudo-Liquefied Catalyst Layer

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A catalyst was developed for production of ethylene oxide in a pseudo-liquefied layer. An investigation of the kinetics of the process was carried out at high concentrations of ethylene in the reaction mixture at constant concentrations of promoters in the gaseous phase. It was demonstrated that the reaction rate of the process is proportional to the oxygen concentration and that the reaction is retarded by the reaction products. The hydrodynamics of pseudo-liquefaction were also investigated.

### Kinetics of Oxidation of Propylene into Acrolein Over a Copper Catalyst

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A study was made of the kinetics of oxidation of propylene into acrolein over a copper oxide catalyst in a recycle-continuous operation. It was shown that increasing propylene concentration improves selectivity of the process. The kinetic equations for oxidation of propylene to acrolein and carbon dioxide are as follows:

$$W_1 = \frac{k_1[O_2][C_3H_6]^0}{1 + b(\text{Product})}; \quad W_2 = \frac{k_2[O_2]}{[C_3H_4O]^{0.7}[C_3H_6]^{0.2}}.$$

Under normal operating conditions the activation energies of formation of acrolein, $E_{acr}$, and of carbon dioxide, $E_{CO_2}$, were found to be $30 \pm 2$ and $36 \pm 2$ kcals/mole, respectively. On the other hand, in absence of the retarding effect of the reaction products the activation energy values for acrolein and carbon dioxide were determined to be $E_{acr} = 20 \pm 1$ and $E_{CO_2} = 26 \pm 1$ kcals/mole.

A parallel-series scheme of operation for catalytic oxidation of propylene was also found workable.

### Transfer Processes in Catalytic Oxidation of Propylene

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An investigation was made of the effects of heat and material transfer stages both to the outer and to the inner surfaces of catalyst granules. It was demonstrated that the processes of mass- and heat transfer to the outer surfaces have no effect on the overall reaction rate of the process. The effect of the two transfer processes within the granules depends upon porosity of the catalyst and concentration of copper in it. In a majority of cases, the difficulty to recover the acrolein from the interior of the pores accounts for a decrease in selectivity.

### Oxidation of Propylene to Acrolein Over Cu-on-$Al_2O_3$ Catalysts Modified by Molybdenum Oxides

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Active aluminum oxide-based catalysts were prepared for oxidation of propylene into acrolein.

A study was also made of the kinetics of oxidation of propylene over Cu-on-$Al_2O_3$ catalysts, using oxides of molybdenum and of tungsten as modifiers.