

OXIDATION OF ALKANES BY ATMOSPHERIC OXYGEN IN  $\text{CH}_3\text{CN}$  OR  $\text{CH}_2\text{Cl}_2$   
CATALYZED BY  $\text{AuCl}_4^-$  IONS UPON LIGHT IRRADIATION

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Gold complexes [1] are relatively rarely used in catalysis [2]. We have found that the irradiation of solutions of  $\text{HAuCl}_4$  (I) in acetonitrile or  $(\text{C}_6\text{H}_5)_4\text{NAuCl}_4$  (II) in  $\text{CH}_2\text{Cl}_2$  in the presence of saturated hydrocarbons in the air leads to the formation of the corresponding alcohols and ketones. The irradiation was carried out using the full light of a 250-W DRL-250(6) luminescent lamp in a cylindrical glass vessel encased in a water-cooling jacket ( $\lambda > 310$  nm,  $15^\circ\text{C}$ ) with rapid stirring. The concentration of (I) or (II) was  $5 \cdot 10^{-4}$  mole/liter and the substrate concentration was 0.46 mole/liter. The photooxidation results are presented below with the product concentrations given in parentheses ( $\times 10^2$ , mole/liter). The irradiation of cyclohexane in the presence of (I) over 20 h gave cyclohexanol (1.33) and cyclohexanone (1.52). The irradiation of cyclohexane in the presence of (II) over 29 h gave cyclohexanol (1.80), cyclohexanone (1.49), and cyclohexyl chloride (0.05). Ethylbenzene in the presence of (II) over 13 h gives 1-phenylethanol (0.44) and acetophenone (0.96). All these reactions proceed with an induction period. Methanol (0.018) and formaldehyde (0.17) are formed upon the slow bubbling of methane and air through a solution of (I) and irradiation for 10 h. The irradiation of a solution of hexane in  $\text{CH}_2\text{Cl}_2$  in the presence of  $8.3 \cdot 10^{-4}$  mole/liter (II) over 6 h gives 1-hexanol (0.065), 2-hexanol (0.133), 3-hexanol (0.133), hexanal (0.077), 2-hexanone (0.177), and 3-hexanone (0.177). Products of the oxidation of hydrocarbons under the conditions studied were not observed in the absence of gold(III) complexes.

LITERATURE CITED

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