

THE EFFECT OF FUNDAMENTAL PROPERTIES OF ELECTRODE  
MATERIALS ON ELECTROCATALYSIS

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The most important aspect of electrocatalysis is the mechanism of charge transfer at the metal solution interface and the various factors affecting it. To elucidate major factors affecting the catalysis, the kinetics of  $\text{Fe}^{2+}/\text{Fe}^{3+}$ , and also of  $\text{H}^+/\text{H}_2$  reactions were studied on a number of metals and alloy electrodes, as well as on electrodes of some complex compounds. Studies with the  $\text{Fe}^{2+}/\text{Fe}^{3+}$  redox system are of particular interest as they provide information about the role of electrodes in a charge transfer reaction in the absence of complicating adsorption. The  $\log i_0$  values at Pt, Rh, Ir, Pd, and Au are found, for this system, to be linearly dependent on the work function. The linearity was also observed with atomic composition in Au-Pd and Au-Pt alloys. Several carbide electrodes ( $\text{TiC}$ ,  $\text{TaC}$ , and  $\text{B}_4\text{C}$ ) and tungsten bronzes with a general formula of  $\text{Na}_x\text{WO}_3$  ( $x < 1$ ) exhibited stability and activity comparable to those of noble metals in the redox reaction. The importance of the electronic factors in electrode catalysis is demonstrated for  $\text{H}^+/\text{H}_2$  reaction by the linear relation established between  $\log i_0$  and per cent d-character in Au-Pd and Au-Pt alloys. The observed changes in the activities for these reactions at different metals or with different alloy compositions are discussed in relationship to the physical properties of metals and alloys.