# Electrocatalytic Evaluation of the Temperature Dependence of the Degree of Dispersion

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By using the charging curves technique, the degree of dispersion of electrocatalyst was determined. The temperature dependence was also evaluated.

Degree of dispersion of catalysts finds abundant industrial importance in the characterization of the catalysts(1). Proven industrial catalysts possess a very high degree of dispersion. Larger the dispersion, larger is the flux of the reactant and sooner the reaction products are realized. In the earlier studies the electrochemical routes of evaluation of the parameter has been described (2,3). In the current short communication, the temperature dependence of the degree of dispersion of the metal catalysts is described.

## MATERIALS AND METHODS

Platinized-platinum electrodes were used in the galvanostatic charging curves procedure. The type of electrode used, the electrode preparation, the cell used for the current investigations are as already described elsewhere(4-6). The charging curves procedure is also as described already (4-7). The experiments were performed at the 3 selected temperatures (4°, 60° and 80° ±1°C).

## RESULTS AND DISCUSSION

With a freshly plated-platinum electrode, the anodic galvanostatic charging curves obtained had shown continuously decreasing hydrogen arrests with increasing ageing period. This was because of the intrinsic slow sintering aptitude of the very freshly plated platinum matrix. During the study it was also noticed, that a very stable equilibrium platinum electrode could be realized by the following two ways:

(a) By subjecting the electrode to anodic-cathodic polarization for about 30-40 cycles with fresh experimental electrolytes.
(b) By subjecting the electrode to remain in hot boiling ( ~ 90°C) distilled water for about 6 hours. The reproducibility of the anodic charging curves were confirmed by consequent estimations of the true surface area through the charging curves route. Hence, the anodic galvanostatic charging curves obtained with a stabilized platinized platinum electrode in 0.5 M $H_2SO_4$ at the three representative temperatures presented in the Fig.1 show that the surface area increased with increasing temperatures. The standard plating procedure adopted gave the plated platinum mass to be $4.365 \times 10^{-2}$ g or the charge spent for

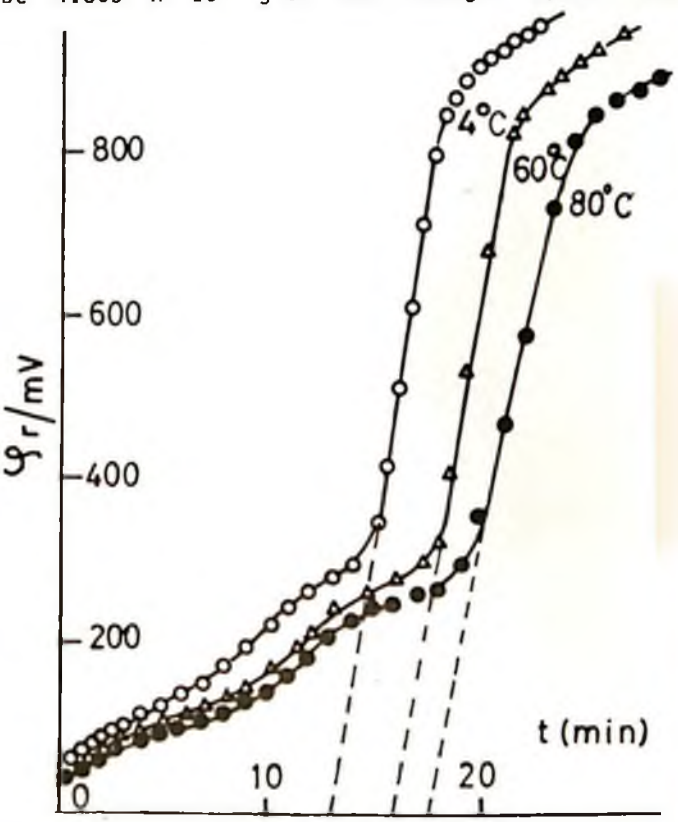



Fig. 1 Anodic galvanostatic charging curves for the oxidation of hydrogen present on the platinised - platinum electrode at 4°, 60° and 80°C and in 0.5 M sulphuric acid at $1 \times 10^{-4}$ amp/cm$^2$ (geom).

plating to be 86.4 coulombs. The charges spent for oxidising the chemisorbed hydrogen present at the three representative temperatures are :

| | |
|---|---|
| 4°C | 0.384 coulomb |
| 60°C | 0.432 coulomb |
| 80°C | 0.480 coulomb |

These charges correspond to the amount of platinum present at the surface at the three temperatures.

These are usually depicted as (S) when we talk about the degree of dispersion. The total number of metal atoms present in the whole of the catalyst is depicted as (M) and is 86.4 coulombs (from the plating conditions). Hence, (S)/(M) at the three temperatures are :

0.44%, (4°C), 0.5% (60°C) and 0.56% (80°C)

Hence, the charging curves method could be used advantageously for following the temperature dependence of degree of dispersion of metallic catalysts.

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