EFFECT OF SOME PARASITE SURFACE REACTIONS ON THE VARIATION OF ELECTRICAL CONDUCTANCE IN THE H₂-Pt/Al₂O₃ SYSTEM

Mariana Stoica, Monica Căldăraru, Alice Căpritză and N.I. Ionescu
“I.G. Murgulescu” Institute of Physical Chemistry of the Romanian Academy, Spl. Independentei 202, 77208 Bucharest, Romania

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Abstract
The charge transfer at the interface H₂-0.5% Pt/Al₂O₃ was studied by using the transient response of the AC electrical conductance. The transient response for water and oxygen contaminated surface was of the overshoot-type.

Keywords: Electrical conductivity, platinum catalysts, transient response.

It is well known that studies related to gas adsorption on catalytic surfaces start with preparation of a clean surface [1]. The presence of a large diversity of surface contaminants arising either from the catalyst precursors (during the preparation stage) or provided by the ambient (during the storage and/or the surface cleaning treatments) favors the occurrence of a great variety of surface reactions, most of them unknown [2]. Since usually the surface pretreatment of platinum catalysts consists of reduction with hydrogen, it would be interesting to follow the influence of some usual surface contaminants on the nature of hydrogen-platinum interaction.
In the present paper, the charge transfer during the hydrogen treatment of a standard 0.5%Pt/Al₂O₃ (Sinclair Becker) catalyst containing as known contaminants oxygen and adsorbed water was followed by using the transient response \([3]\) of the AC electrical conductance \((\text{G})\).

**EXPERIMENTAL**

The description of the experimental set-up and details concerning the dynamic reactor for *in situ* measurement of the electrical conductance have been presented elsewhere \([4,5]\). The measurement of the AC electrical conductance has been done by using a TESLA BM 484 RLC semiautomatic bridge at a fixed frequency of 1592 Hz. Simultaneously, the amount of water evolved in the effluent was measured by gas-chromatography.

A standard 0.5% Pt/Al₂O₃ (Sinclair-Becker) has been used without previous reduction, thus containing as main contaminants (resulting from preparation and storage) water and oxygen.

The transient response \(\text{H}_2\) (inc.,0) - G, produced by switching rapidly the argon flow to hydrogen flow at room temperature, has been measured for each catalyst sample (2.59 g) pretreated in different ways, namely:

1. Flushing with argon for 15 h, at room temperature;
2. Pretreatment 1, followed by two successive cycles of temperature programmed heating (20 K/min) up to 673 K and cooling in argon flow;
3. Flushing with humid argon (2.5 mg of water/L) at room temperature up to surface saturation with water, followed by flushing with oxygen and removal of weakly bonded species by flowing dry argon;
4. Temperature-programmed heating (1 K/min) up to 623 K in hydrogen flow, followed by cooling in hydrogen flow to room temperature;
5. Pretreatment 4, followed by flushing with argon, oxygen and draining with argon.

The gases (research grade) have been specifically purified by using molecular sieves, silica gel and Deoxo units.

Every stage lasted as long as necessary to attend quasi-stationary values of conductance \(\text{G}\). The flow rate was in all cases 50 mL/min.