

in an organic vehicle are used in the production of resistors that are particularly suitable for printed and micro circuits (9). The preparations are applied by screen printing to flat glass and ceramic substrates, and by dipping, or banding machine to rods and other shapes, and fired at 650 to 800°C to produce resistors with values ranging from 1 ohm to 20 megohms, depending on the proportion of palladium, silver and frit in the preparation, and the attenuation of the current path in the resistor design. Good reproducibility of values is claimed by close control of the particle size of the paste constituents and processing conditions. The resistors are claimed to have low temperature coefficients and low current noise; the latter is attributed to sintering of the metal particles when the preparation is fired, resulting from the high alloying tendency of the palladium and silver powders, thus minimising contact resistance between the particles.

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# The Release of Hydrogen Atoms from the Surface of a Platinum Catalyst

## GASEOUS OR SUPERFICIAL MIGRATION ?

The reduction of yellow tungsten oxide,  $\text{WO}_3$ , to the blue  $\text{W}_4\text{O}_{11}$  is effected at room temperature by hydrogen atoms but not by hydrogen molecules and so this reaction can be used as a means, both qualitative and quantitative (1), for the detection of hydrogen atoms. Khoobiar, of Esso Research and Engineering Company, has recently shown (2) that when molecular hydrogen is passed at 50°C over a mechanical mixture of platinum on  $\gamma$ -alumina reforming catalyst and  $\text{WO}_3$ , a blue coloration appears immediately. This indicates that hydrogen atoms have been formed on the platinum surface and that they have migrated over the alumina support (possibly as protons) before reaching the  $\text{WO}_3$  which is then reduced. A mixture of  $\text{WO}_3$  and  $\gamma$ -alumina had to be heated to 200° before any sign of reduction appeared.

Kohn and Boudart, working at the University of California, have reported some further

related experiments (3). They observed that on mixing reduced platinum-alumina catalyst with  $\text{WO}_3$  in hydrogen no visible reaction occurred at room temperature, but on admission of oxygen the gradual appearance of the blue coloration was noted. They concluded that the migration of hydrogen atoms occurs through the gas phase, hydrogen atoms being released from the platinum surface by the reaction



This interesting system deserves further attention, especially since it could provide a ready means of assessing the state of dispersion of platinum on its support. G. C. B.

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