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PLATINIZED NICHROME AND NICHROME-PALLADIUM.
I. METHOD OF PREPARATION AND EXTENT OF APPLICABILITY.

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This is a condensed translation of the original article.

In connection with the expansion of scientific researches, a reduction of the consumption of platinum and platinum-group metals is a very desirable objective. The authors have worked for over a year a new catalyst, and the success of this catalyst points to the possibility of using it as an active, convenient and cheap substitute of platinum and palladium (1 - 3).

This catalyst, platinized nichrome and nichrome-palladium, is prepared in a very simple manner. The surface of nichrome wire, ribbon, plates, etc., is first oxidized by heating to 800° and is then coated with the Kundt solution, used for platinizing, and composed of 1 g. platinic chloride dissolved in 3 ml. alcohol. To this solution 10 ml. of a saturated solution of boric acid in alcohol is added, and then 20 ml. of a 1 : 1 mixture of turpentine and oil of lavender. The mixture used for palladizing is similarly compounded. At the time of writing this article the authors experimented with solutions of salts of platinum and palladium in turpentine and alcohol, to which hydrochloric and boric acids were added, and also attempted to substitute oil of lavender by more generally available essential oils. Some results were quite satisfactory.

After drying, the nichrome is ignited to 800°. Despite the minute quantities of platinum or palladium thus charged on the surface of the oxidized nichrome, a single treatment is sufficient for obtaining a highly active preparation. The amount of platinum on the surface is seen from the following: A single coating of glass with the solution described will leave a layer of platinum 40 - 60 mm. Direct weighing and calculating the amount of platinum from the volume of its solution consumed in coating give sufficiently agreeing data. The coating was usually repeated 2 to 3 times.

Platinum and palladium reduced to metal are very widely scattered on the well developed surface of the oxides of nichrome, and the layer of oxides insulates the particles of platinum and palladium from the nichrome itself. These two facts are thought by the authors to exert a material beneficial effect on the stability and activity of the catalyst. The layer of oxides reliably protects the particles of platinum from contact with metallic nichrome. This prevents the platinum from fusing with the metal of the carrier, even at very high temperatures. It is generally known that this possibility has to be reckoned with, even in inextensive heating. For instance, platinum alloys with copper on the interface already at 350° (4). Oxides of nichrome are firmly held on

the surface, forming an exceedingly well developed surface, as was shown by a microphotographic (magnification 500) and X-ray analysis, which was performed at the Khar'kov Institute of Chemical Technology. The reduced platinum of particle size, of the order of magnitude 0.1 micron according to the above data, is scattered on the very large surface.

The possibility of enlargement of the particles of metal as a result of recrystallization, with attendant reduction of the number of active centers and of the effectiveness of the catalyst, is negligibly small. The experience of the authors revealed that the activity of the catalyst remains perfectly unchanged within 300 or more hours of work at temperatures up to 800°. Platinized nichrome does not suffer from uncontrollable superheating, since the metallic carrier has an excellent heat conductivity and the thin layer of oxides is also sufficiently conductive. Regulation of the temperature thus presents no problems. The high thermal stability of the active layer of platinum-nichrome was revealed in the experiments of the authors. Prolonged heating did not reduce its activity. The temperature of initial oxidation of hydrogen remained +73° for platinized nichrome and +17° for palladium-nichrome.

X-ray analysis showed that instead of 3.903 Å, the lattice constant after catalytic experiments was $3.935 \pm 0.002$ Å. In addition, the thermal recrystallization was shown by the width of the individual lines to have effected a rise of the crystallites from $3 \times -4$ to $3 \times 10^{-3}$. This change did not affect the catalytic activity of platinum-nichrome, and its high and uniform activity and thermal stability were observed within the wide interval of from room temperature to 1,000°.

The convenience of use of this catalyst in oxidizing reactions, lack of local superheating, ease of exact regulation of the temperature by direct heating by electric current, make this catalyst well suitable for gas analysis. Very low cost, due to the content of platinum or palladium amounting to hundredths of a per cent, and simplicity of preparation make it a very serious competitor for platinum and platinum-group metals in analytical equipment.

In addition to analysis of gaseous and liquid hydrocarbons, the authors have employed these catalysts under conditions of high rates of flow, exceeding 10,000 l./hr., for the purpose of complete elimination of combustible and explosive admixtures from the air, or carbon monoxide or hydrogen. Further, the following applications have already been established by testing under rigid conditions: 1. Quantitative determination of hydrogen, carbon monoxide, acetylene and methane. 2. Analysis of a three-component gas mixture, including methane, by selective combustion (6). 3. Quantitative determination of benzene and its homologs as well as of gasoline vapors. 4. Successful substitution of platinized and palladized asbestos, ceramics, quartz, Drehschmidt capillary containing either platinum or palladium, platinum and palladium black, Dennstedt tubes, etc.

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