determination of the temperature of the surface of powders from thermal radiation during the sysnthesis of catalysts of the platinum group [[1]](#footnote-1)\*)

DOI: 10.34854/ICPAF.2022.49.1.150

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Results are presented of the determination of the temperature of the surface of powders in experiments on plasmachemical synthesis of catalysts of the platinum group (for the transformation of hydrocarbons) in the mixtures of aluminum oxide Al2O3 with palladium Pd and Al2O3 with platinum Pt with different concentrations.

The temperatures were determined from the slope of the line approximating the spectrum drawn in the so-called Wien coordinates. The thermal radiation spectrum of an object with an arbitrary emissivity ε(λ, T) is described by the expression

, (1)

where *C*1 = 37418 W µm4/cm2 and *С*2 = 14388 µm grad are Wien’s constants, the wavelength is calculated in µm, and the spectrum intensity is calculated in W/(cm2 µm).

In Wien’s range, where , after a transformation, we get

(2)

For a gray body (ε = const), this expression is the equation of a straight line in the plane (*x*, *y*), where and are Wien’s coordinates. The slope of the line is determined by the temperature. In the presence of atomic lines and molecular bands, expression (2) is the bottom tangent line to the spectrum, which allows one to determine the temperature of the radiating body in the case where approximating the spectrum by such a line is possible, i.e., when the radiating object is a gray body [1].

The obtained estimates of the surface temperature are (2900 –  2700) ± 200 K for the mixture of Al2O3 with 1% Pd and (2800 – 2700) ± 200 К for the mixture of Al2O3 with 10% Pd [2] and it lies between the melting and boiling points at atmospheric pressure of both components of the powder mixture, which creates appropriate conditions for the initiation of self-sustained (chain) plasma-chemical reactions. For mixtures of Al2O3 with Pt, the surface temperature is (2400 – 2200) ± 200 К for the mixture of Al2O3 with 10% Pt and (900 – 700) ± 200 К for the mixture of Al2O3 with 20% Pt, which makes more understandable the larger difficulty we had to ignite discharges when the only metal in the mixture was Pt, which is characterized by higher melting and boiling temperatures than Pd, and whose vapor density is 2–3 order of magnitude lower than that of Pd at the same temperature.

This work was supported by State Assignment GZ BV10-2021 "Study of Innovative Synthesis of Micro- and Nanoparticles with a Controllable Composition and Structure Based on Microwave Discharge in Gyrotron Radiation".

References

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2. Voronova E.V., Knyazev A.V., Letunov A.A., Logvinenko V.P., Skvortsova N.N., Stepakhin V.D. «Temperature of the Surface of Powders in Experiments with Chain Plasma-Chemical Reactions Initiated by the Radiation of a Gyrotron in Pd + Al2O3 Mixtures» // Physics of Atomic Nuclei. 2021. V. 84. No. 9. doi: 10.1134/S1063778821090374 [in print]

1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLIX/Pt/ru/HF-Voronova.docx) [↑](#footnote-ref-1)