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GAS-KINETIC TEMPERATURE OF THE PLASMA OBTAINED BY PULSED RADIATION OF A GYROTRON IN TiO₂ + Cu POWDER MIXTURES^{*)}

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The plasmachemical synthesis of material using microwave radiation has found many applications in recent years [1, 2]. The synthesis is based on the ability of microwave radiation to initiate chain reactions between the mixture components that are repeated multiple times. The composition of the reaction products and their size distribution are determined by the experimental conditions, which makes measuring the temperature important. The reactions of synthesis of the copper-based catalysts were carried out using microwave radiation with a power of 300 kW at pulse duration of 8 ms. The copper content in the mixture varied between 0.1% and 20% by weight. The radiation was recorded by an AvaSpec-3648-USB2 spectrometer with the following characteristics: a spectral range of 367–909 nm, spectral resolution of 0.45 nm, and a pixel size of 0.15 nm. The breakdown of the mixtures was ensured by using an initiator made from chaotically intersecting strips of stainless steel. The gas-kinetic temperature was measured using the radiation spectrum of the γ system of the TiO molecule at the start of the gyrotron pulse, 4 ms after the start of the pulse, and at the end of the radiation of the molecule, 8 ms after the start of the pulse. The calculation of the temperature was done using the ratio of intensity of the head of the R branch found at 705.42 nm and the intensity of the spectral background in its immediate vicinity [3]. The table below shows the calculated values of temperature at different times during the discharge for mixtures with different copper contents.

Powder composition	T, K start of gyrotron pulse	T, K middle of gyrotron pulse	T, K end of gyrotron pulse
TiO ₂ + 0.1% Cu	6100 ± 500	5600 ± 500	6000 ± 500
TiO ₂ + 1% Cu	5400 ± 500	5500 ± 500	5300 ± 500
TiO ₂ + 2% Cu	5200 ± 500	5600 ± 500	6400 ± 500
TiO ₂ + 5% Cu	5400 ± 500	5700 ± 500	5100 ± 500
TiO ₂ + 10% Cu	5600 ± 500	5600 ± 500	6000 ± 500
TiO ₂ + 20% Cu	5000 ± 500	5600 ± 500	5800 ± 500

The table of results shows that the temperatures do not change during the gyrotron pulse for all mixtures, regardless of the mixture composition. Thus, the copper content does not significantly affect the heat balance of the reaction in the synthesis of the catalysts.

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^{*)} [abstracts of this report in Russian](#)