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# Radiation of atoms and ions of metals in the plasmachemical process initiated by the radiation of a powerful pulsed gyrotron in mixtures of magnesium and titanium oxide powders

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***Results are presented of spectroscopic measurements of the plasma radiation in microwave discharges in experiments on the synthesis of micro and nanosized catalytic structures under the action of powerful microwave radiation pulses produced by a gyrotron (the wavelength is 4 mm, the pulse duration is 2–8 ms, and the power is up to 500 kW) on the mixture of magnesium Mg and titanium oxide $TiO_2$ powders. The experiments were carried out in air. The radiation spectra of the microwave discharges were recorded by a set of AvaSpec spectrometers of different types in the wavelength range from 219 to 920 nm. Spectral lines of neutral atoms and singly ionized ions of magnesium and titanium were recorded. The characteristics of the spectral lines were studied during the microwave radiation pulse interaction with the powder mixture and after its end. The analysis of the obtained results showed that for titanium atoms, the condition of the local thermodynamic equilibrium (LTE) is fulfilled, which allows one to make reliable estimates of the electron temperature of the plasma, which ranges from 0.2–0.4 eV. At the same time, for titanium ions, the LTE condition is not fulfilled in the microwave discharge. The comparable intensities of the atomic and ionic titanium lines in the discharges at the electron temperature of 0.2–0.4 eV, which is more than one order of magnitude lower than the ionization potential of titan, show that the plasma of the microwave discharge in the powder mixture is strongly inhomogeneous. The bands of titanium monoxide TiO recorded in the radiation of the microwave discharge indicate that plasmachemical reactions occur in the discharge.***

*Keywords*: gyrotron, microwave discharge in a mixture of metal and metal oxide powders, low-temperature plasma, synthesis of micro and nanoparticles, atomic, ionic and molecular spectra, plasma chemistry.

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