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INVESTIGATION OF ANTIOXIDANT PROPERTIES OF CERIUM OXIDE NANOPOWDERS UNDER NANOSECOND BREMSSTRAHLUNG*

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Cerium oxide CeO_2 nanoparticles (CONP's) possess unique properties, among which is the ability to inhibit free radicals [1]. The antioxidant (AO) activity of CONP's has been well studied [1], however, a quantitative and comparative assessment of the antioxidant properties of these and other nanoparticles is difficult due to the imperfection of currently existing methods.

Various methods of obtaining nanopowders can significantly affect their properties. In this work, the AO properties of CONP's obtained by the pulsed electron beam evaporation (PEBE) method in vacuum were investigated [2]. The PEBE method enables to obtain CONP's with a high specific surface area (up to 190 m^2/g) [2] and a high content of Ce^{4+} (68%) [3], which ensures their high AO activity.

Quantitative assessment of AO properties was performed using a ferrous sulfate dosimeter (FSD). The principle of operation of FSD is based on the oxidation of trivalent iron Fe3+ by free radicals formed under the ionizing radiation. The AO ability of nanoparticles allows to change the amount of free radicals, which is expressed in a change in the absorbed dose.

For the analysis, CONP's were added to the FSD solution at a concentration of 100 mcg/ml. The obtained samples with and without CONP's were irradiated with bremsstrahlung at the URT-1M accelerator [4] (convector made of steel-3 with a thickness of 1 mm). After irradiation, the optical density of the samples was measured at a wavelength λ = 304 nm on a "5300UF Ekroschim" spectrophotometer. The measurement results are shown in Figure 1.

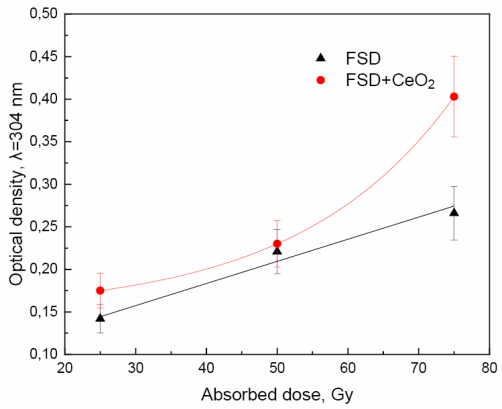

Fig.1. Dose dependance of optical density on wavelength 304 nm of FSD with and without nanoparticles.

The obtained results show that the addition of CONP's led to a violation of the linearity of the FSD, which indicates the operability of the proposed technique. However, it is necessary to clarify the effect with increased absorption of low-energy photons by heavy cerium atoms [5].

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