Contribution ID: **1699** Type: **Oral**

Gd2O3@SiO2 nanoparticles with core-shell structure for magnetic resonance imaging and computed tomography

Tuesday 29 October 2024 13:15 (15 minutes)

The continued development of multimodal medical imaging creates demand for contrast agents (CAs) that can be used with multiple imaging techniques. An example of such CAs are Gd-based materials that can be used in magnetic resonance imaging (MRI) and computed tomography (CT), including photon-counting CT. A type of Gd-based material of special interest is nanoparticles with a core-shell structure consisting of a Gd-containing core and a shell formed by amorphous SiO2 with a surface modified with functional groups [1].
The purpose of this work was to produce particles with a core-shell structure Gd2O3@SiO2 and prove their structure for subsequent use as contrast agents for computed tomography and MRI.
Gd2O3 nanoparticles were produced by precipitation of Gd2(C2O4)3*10H2O with subsequent decomposition at 750 ℃ in an air atmosphere. The particle size, according to scanning electron microscopy (SEM), was 200-500 nm. The particle size in an aqueous suspension, measured by the method of optical scattering of particles suspended in water, was 5-10 μm, which probably corresponds to the size of the associates. Particles with a core-shell structure were produced by treating Gd2O3 with (EtO)3SiC3H6NH2 (γ-APTES) and then with H2O vapors in a fluidized bed reactor. In this case, the treatment time with γ-APTES was varied from 5 to 30 min, and the temperature of the reactor working zone was varied from 150 to 250 ℃ [2].
According to IR spectroscopy data, all produced preparations contained a characteristic peak of [SiO4] at 1100 cm-1. According to TG data, the weight loss at 250-600 ℃ was from 0.8 to 1.2 wt. %, that corresponds to different contents of functional C3H6NH2 groups.
This research was supported by Russian Science Foundation (project number 22-15-00072).

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Session Classification: Applied Research

Track Classification: Applied Research