28th International Scientific Conference of Young Scientists and Specialists (AYSS-2024)

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

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

вторник, 29 октября 2024 г. 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 (ɣ-APTES) and then with H2O vapors in a fluidized bed reactor. In this case, the treatment time with ɣ-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).

Literature:
1. Evgeniya Suslova, Denis Shashurin, Zukhro Zoirova, Alexey Shumyantsev, Oleg Medvedev, Georgy Chelkov. Gd2O3-based contrasting agents for photon-counting computed tomography: Effect of structure, composition, and particle size. Materials Chemistry and Physics, Volume 313, 2024, 128733, ISSN 0254-0584. https://doi.org/10.1016/j.matchemphys.2023
2. Amirhossein Mahtabani, Damiano La Zara, Rafał Anyszka, Xiaozhen He, Mika Paajanen, J. Ruud van Ommen, Wilma Dierkes, Anke Blume. Gas Phase Modification of Silica Nanoparticles in a Fluidized Bed: Tailored Deposition of Aminopropylsiloxane. Langmuir 2021, 37, 15, 4481–4492. https://pubs.acs.org/doi/10.1021/acs.langmuir.0c03647.

Primary authors: KUPRIIANOV, Anton (Chemistry department, Lomonosov Moscow State University); Dr SHASHURIN, Denis (Faculty of Medicine, Lomonosov Moscow State University); Dr SUSLOVA, Evgeniya (Chemistry Department, Lomonosov Moscow State University); Dr SHELKOV, Georgiy (Joint Institute for Nuclear Research)

Presenter: KUPRIIANOV, Anton (Chemistry department, Lomonosov Moscow State University)

Session Classification: Applied Research

Track Classification: Applied Research