Functionalized LnF_3 nanoparticles as multimodal contrast agents for PET, MRI and Luminescence imaging

C. Heinritz,[1] A. Ouadi,[2] D. Brasse,[2] C. Po,[3] S. Bégin,[4] M. Botta, [5] F. Carniato, [5] S. Harlepp, [5] A. Detappe, [5] C. Cheignon,[1] L. Charbonnière,[1] A. Nonat[1]

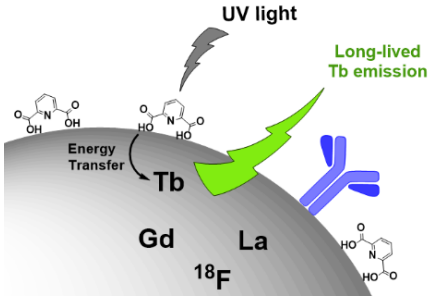
[1] Equipe de Synthèse pour l'analyse, IPHC, CNRS, 67200 Strasbourg, FR
[2] Equipe Imagerie Moléculaire et Radiobiologie, IPHC, CNRS, Strasbourg, FR
[3] iCube - Laboratoire des sciences de l'ingénieur, de l'informatique et de l'imagerie, Strasbourg, FR
[4] Chemical Engineering of Functional Nanomaterials, IPCMS, CNRS, Strasbourg, FR
[5] Università del Piemonte Orientale, Alessadria, IT
[6] ICANS – Institut de cancérologie, Strasbourg, FR

Email address: charlotte.heinritz@etu.unistra.fr

Positron Emission Tomography (PET), Magnetic Resonance Imaging (MRI) and Luminescence Imaging being well employed techniques for medical diagnostics, interest in the development of multimodal contrast agents arises to facilitate the *in vitro* and *in vivo* detection in multimodal scanners. Our goal is the development of such trimodal agents based on Lanthanide Nanoparticles (Ln NPs).

The interesting spectroscopic and magnetic properties of Ln give rise to unique characteristics of the Ln NPs. Ln-containing compounds are used in probes for luminescence imaging and, especially in the case of Gd(III) for MRI.[1] The low intrinsic absorption of Ln and thus difficult photosensitization, can be overcome by indirect photosensitization through light-harvesting capping ligands (called antennae) on the NP surface, allowing exceptional high brightness of Ln NPs.[2]

We report here the microwave-based synthesis of $La_xGd_yTb_zYb_{1-x-y-z}F_3$ NPs and the characterization of these novel nano-objects in terms of size, stability, crystal structure, relaxation properties and composition. The dependence of the magnetic, luminescent and structural properties on the Ln ratio in the NPs is discussed. The brightness of the NPs after addition of antennae, the MRI images of phantom solutions as well as the PET images of phantom solutions after addition of radiotracers ^{18}F or ^{89}Zr during the NP synthesis present a proof-of-concept for the trimodality of the NPs. *In*- and *ex*-cellular TEM images of NPs are shown as well as modification trials to allow biological targeting *via* a NP-surface coordinated antibody. Advanced spectroscopic properties, such as anti-Stokes emission or 'upconversion' are also being developed with the aim to enlarge the application scope of these Ln NPs for imaging.



Scheme of a ^{18}F doped trimodal Ln NP surface-capped with photosensitizing antennae (dipicolinic acid) and antibodies for biological targeting.

References :

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