Área: MAT

Combining upconversion and persistent luminescence nanomaterials to produce rechargeable bio-emitters

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Palavras Chave: Persistent Luminescence, Upconversion, Bioimaging, Nanomaterial, Energy storage, In vivo.

Highlights

NIR to green upconversion followed by radiative energy transfer allows charging-recharging of NIR persistent luminescence. In-vivo imaging after nanocomposites sub-cutaneous or oral administration.

Resumo/Abstract

Persistent luminescence in the infrared region is highly desirable due to potential applications in bioimaging [1]. However, it is important to be able to recharge the nanoparticles inside the body to increase the timescale of the imaging. Recently, there is a rush to find ways to charge persistent luminescence using an infrared laser as a power source and an upconversion process. This would allow the expansion of the potential applications for these materials, since both excitation and emission are fully inside the biological window. In this work, by using two materials associated via dry impregnation: β-$NaGd_{0.8}Yb_{0.17}Er_{0.03}F_4$ nanoparticles, known for their efficient upconversion, and $Zn_{1.33}Ga_{1.335}Sn_{0.33}Cr_{0.005}O_4$ nanoparticles, known for their persistent luminescence properties we effectively observed radiative energy transfer. This hybrid material exhibited persistent luminescence at 700 nm after charging with a 980 nm laser. Due to this property, in vivo tests with the composite (Figure) confirmed its potential application in bioimaging. Finally, a mechanism was proposed to explain this energy transfer process and the positive results of these tests demonstrate the effectiveness of our novel approach in recharging persistent luminescence and its potential for wider use in the future.

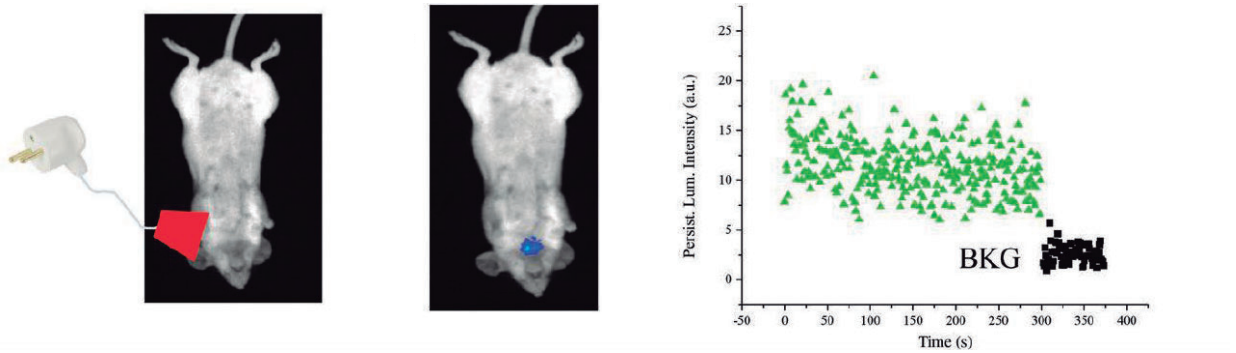

Figure. (left) Excitation of a capsule orally adminstated in a mice using a 980 nm laser. (center) Counts after in situ excitation. (right) Decay of in situ persistent luminescence.

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Reference

[1] Frtizen, D.L.; Giordano, L.; Rodrigues, L.C.V.; and Monteiro, J.H.S.K; Nanomaterials 10 (2020) 2015.