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Materials for scintillation and bio-imaging, Focus on the control of the kinetics

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In medical imaging, the development of luminescent materials in various shapes (from single crystals to nanoparticles) requires perfect materials with high fluorescence intensity but also with careful control of the defects which could affect the kinetic of the luminescence. For instance, afterglow should be avoided in the scintillator crystals in order to obtain clear and fast images in widely developed PET scan imaging and CT tomography (gamma rays and X-rays imaging respectively). The defects/traps must be carefully controlled to avoid room temperature detrapping and afterglow emission which alter the images. Furthermore, on the opposite case, there is a recent large interest for materials with long afterglow luminescence, also called persistent luminescence.

Persistent luminescence is a singular property of some materials which are able to store the excitation or light irradiation energy at intrinsic traps or defects before slowly emitting photons within several hours. Several new applications are envisioned with these materials such as emergency signing, luminous painting, etc. Recently this concept was also proposed for the development of new optical imaging modalities. At nanoscale, deep red and near-infrared persistent luminescence nanoparticles enable highly sensitive *in vivo* optical detection and complete avoidance of tissue autofluorescence. Persistent luminescence can be activated *in vivo* through living tissues using highly penetrating low energy photons, for that purpose with proposed recently an optimized material [1]. Surface functionalization of this photonic probe can be adjusted as well as the wavelength of the optical stimulation to favour multiple challenging biomedical applications [2].

References:

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[2] Liu, J., Lécuyer, T., Saguin, J., Mignet, N., Scherman, D., Viana, B., Richard, C., Imaging and therapeutic applications of persistent luminescence nanomaterials, *Advanced Drug Delivery Reviews*, Vol. 138, **2019**, 193-210