KTP nanocrystals exhibiting high SHG emission for bio-imaging applications

L. Mayer, [†] A. Slablab,[‡] G. Dantelle, [†] V. Jacques, [‡] A.-M. Lepagnol-Bestel,[§] S. Perruchas,[†] P. Spinicelli,[‡] A. Thomas,[#] D. Chauvat,[‡] M. Simonneau[#], T. Gacoin,[†] J.-F. Roch[‡]

[†] Laboratoire de Physique de la Matière Condensée – Ecole Polytechnique-CNRS, UMR 7643, 91128 Palaiseau Cedex, France

[‡] Laboratoire de Photonique Quantique et Moléculaire – ENS Cachan & CNRS, UMR 8537, 94235 Cachan, France

[§] CEA/CNG, Laboratoire Génomique Fonctionnelle, 91057 Evry, France

[#] INSERM 894, Centre Psychiatrie & Neurosciences de l'INSERM, 75014 Paris, France

ludovic.mayer@polytechnique.edu
thierry.gacoin@polytechnique.edu
jean-francois.roch@ens-cachan.fr

Abstract

In the last few decades, numerous works have been devoted to the development of efficient luminescent probes for bio-imaging applications. KTiOPO4 (KTP), a well-known material for its non-linear optical properties (especially second harmonic generation) [1] could be a good candidate as nonlinear optical probe because of its SHG excitation windows laying in the near IR range (transparent for biological tissues) and the possibility to determine the crystal orientation allowing orientation tracking [2].
We present here the coprecipitation synthesis of single-crystal KTP nanoparticles whose size ranges from 200 nm to less than 30 nm. They can be easily dispersed in water and are stable at physiological pH. Using a pulsed Ti-Sapphire laser at a wavelength of 1020 nm and a standard two-photon microscope combined with an Atomic Force Microscope, non-linear optical properties of these particles are investigated. They exhibit a perfectly stable high SHG signal and their crystalline orientation can be fully determined using the SHG high sensitivity to the polarization of the excitation light. We also show the possibility to use these particles as nonlinear optical probe for biology by introducing KTP nanoparticles into a culture medium with mouse primal neural cells. Investigations prove that individual KTP nanoparticles can be imaged inside the cell body and the neurites, while the absence of any visible impact on the short term development of the cells indicates their low toxicity at least for our in-vitro experiments.

References

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Figures