We investigate the use of Bismuth Ferrite (BFO) nanoparticles for tissue labelling. Second Harmonic Generation (SHG) and third harmonic (THG) from BFO nanocrystals are investigated to determine their potential as biomarkers for multiphoton imaging [1]. BFO nanocrystals stable colloidal suspensions with mean particle diameters in the range 100–120 nm are obtained by auto-combustion method, followed by wet-milling and sonication steps. SHG properties are determined using Hyper Rayleigh Scattering and nonlinear polarization microscopy. BFO shows a very high second harmonic efficiency with an averaged $<d>$ coefficient of $79 \pm 12$ pm/V, exceeding by one order of magnitude the response of standard nonlinear crystals (LiNbO$_3$, KTP). Additionally, the particles show a moderate magnetic response, which is attributed to c-Fe2O3 impurities. A combination of high nonlinear optical efficiency and magnetic response within the same particle is of great interest for future bio-imaging and diagnostic applications.

We report the efficient and simultaneous generation of second and third harmonic by the nanoparticles [2]. On this basis, we set up a novel imaging protocol based on the colocalization of the two harmonic signals and demonstrate its benefits in terms of increased selectivity against endogenous background sources in tissue samples. In addition BFO nanoparticles can be used as mapping reference structures for correlative light-electron microscopy.

HeLa fixed cells labelled by BFO HNPs. MP: Multiphoton image. Nile red fluorescence (red), SH by HNPs (blue). SE: backscattered electrons SEM image. BE: secondary electrons SEM images at 5 and 15 kV.

References:
