USE OF RADIAL POLARIZATION MICROSCOPY FOR CHARACTERISING OPTICALLY DETECTED MAGNETIC RESONANCE OF NANODIAMONDS

Martina Barbiero, Philip R. Dolan, Xiangping Li, and Min Gu
Centre for Micro-Photonics, Faculty of Science, Engineering and Technology, Swinburne University of Technology, PO Box 218, Hawthorn, Victoria 3122, Australia
Email: mbarbiero@swin.edu.au

The exceptional electronic and magnetic properties of nitrogen vacancy (NV) centres in nanodiamonds have laid new ground for super-resolved optical sensing applications [1,2]. The non-toxicity and bio-compatibility of nanodiamonds make them indispensable tools for nanoscale in-vivo sensors of living biological systems, which cannot be achieved by the current methods. In particular, the optically detected magnetic resonance (ODMR) of the single electron spin of NV centres at room temperature [3] open an entirely new perspective for ultra-sensitive magnetic imaging of complex biological systems. Instead of using a linear polarization microscopy, here we report on the investigation of nanodiamonds with radially polarization microscopy. The enriched focal field of tightly focused radial polarization enables not only the quick determination of the orientation of the NV axis but also the observation of ODMR signals.

The nanodiamonds with an initial size of 100 nm were oxidized at 450°C for 2 h to reduce the size by removing the graphite layer impregnated with noncarbon impurities on the surface. Negative charged NV centres were imaged with a homebuilt scanning confocal microscope. The beam at the wavelength of 532 nm with radial polarization is employed as the excitation source. An objective with high numerical aperture (NA =1.4) was used to focus the beam and collect the fluorescence signal. The orientation of the NV axis of single NV centres can be precisely determined through the characteristic fluorescence emission patterns when imaged by a radially polarized beam [4]. In addition, we will show the ODMR response excited by the radial polarization. Moreover, when the averaged size of nanodiamonds is reduced to below 70 nm, fluorescence intermittence or blinking occurs [5]. The fluorescence dynamics excited by the radial polarization will be studied by monitoring its time trajectory. The radially polarized beam will be employed to investigate the ODMR response of the blinking nanodiamonds.

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References