FEMTOSESECOND LASER WRITING OF NITROGEN VACANCY CENTRE PATTERNS FOR OPTICAL MAGNETIC IMAGING

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Negatively charged nitrogen-vacancy (NV^-) centres have enabled superresolution imaging and magnetic sensing [1, 2]. Here, we report on a femtosecond (fs) laser fabrication method to produce a pattern of NV^- centres in bulk diamonds, which is potentially applicable for optical magnetic imaging (Fig. 1a). Nanoscale control of the NV^- centres placement is of paramount for biomedical applications like cellular tagging and sensing. A fs laser beam at 800 nm wavelength (30 mW), expanded onto a spatial light modulator (SLM, Hamamatsu X10468-02), is focus on a single crystal plate diamond sample (100, ElementSix Synthetic Industrial Diamonds) through a 40X 0.75 NA lens (Fig. 1b). Further, the bulk diamond is annealed in dry nitrogen for 3 hours at 1000°C [3]. With a confocal microscope, we observe fluorescence at the location of the fabrication when the sample is excite with 561 nm wavelength through a 1.4 NA 100X oil immersion lens (Fig. 1c). The emission spectrum of a fluorescent spot is also measured and confirms the generation of fluorescentNV^- (Fig. 1d) The presented method provides a new approach to opto-magnetic imaging with NV^- centres placed at nanoscale precision within the biological environment.

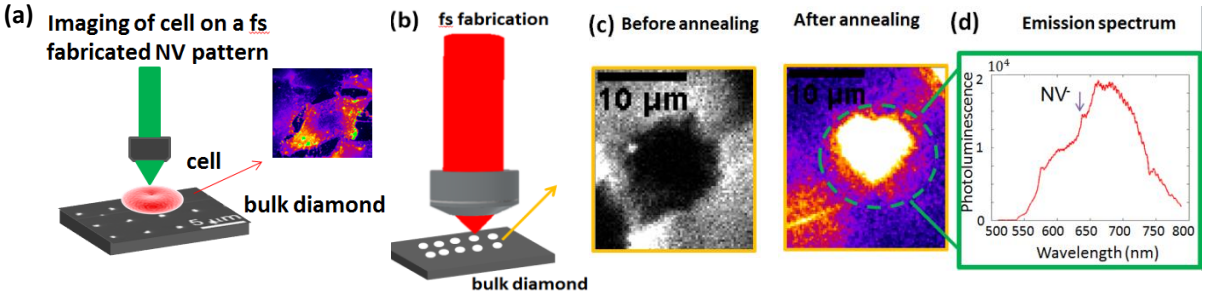

Figure 1: a) Schematic of imaging a cell growth on a **NV^-** pattern fabricated with a fs laser. b) Schematic of the fs laser fabrication method. c) (Left) Confocal image of the pattern after fabrication. (Right) Confocal image of a fluorescent **NV^-** centre after annealing. (d) Emission spectrum that confirms the generation of **NV^-** centres on the bulk diamond.

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