Evaluation of the polarization dependence of an electron spin properties of NV nanodiamond through a near-field etching approach

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Our previous studies already showed that a near-field (NF) etching (Fig.1(a)) is able to improve T_2 coherence times of nitrogen-vacancy (NV) centers in nanodiamonds [1]. In this paper we want to further display how the NF-etching changes the optically detected magnetic resonance (ODMR) spectrum (Fig.1(b)) of nanodiamond NVs and the T_2 Hahn-Echo envelope (Fig. 1(c)).

Far-field light irradiation induces charges at sub-wavelength objects, resulting in the generation of an optical near-field (ONF) around these objects which interacts with matter within sub-wavelength distance to the object (such as gas molecules). Radical oxygen atoms [2,3] are believed to interact with their immediate environment and therefore causing the etching.

To evaluate the polarization-dependent etching [4], we further checked how NF-etching changes the shape of the nanodiamonds along the parallel and perpendicular axis (Figs.1(d) and (e)). Remarkably, the graphical results revealed that the parallel component experienced a higher etching ratio than the perpendicular component, if only slightly.

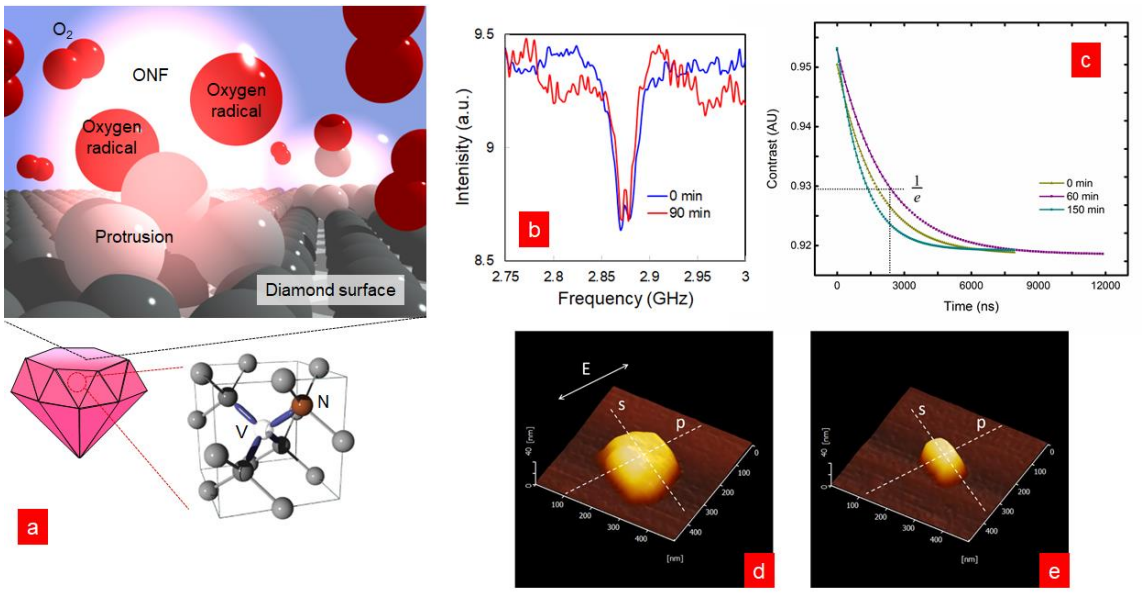

Fig. 1 (a) Schematic of NF-etching on NV nanodiamond. (b) ODMR spectrum of NV in nanodiamond before (blue) and after 90 min of NF-etching (red). (c) Hahn-Echo T2 envelopes before (olive green), after 60 min (pink) and 150 min (teal) of NF-etching. (d) and (e) Graphic showing the AFM images of NV nanodiamond before and after 60 min of NF-etching, respectively. (e)

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