Magnetic Resonance Spectroscopy on a Nanostructured Diamond Chip

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Diamonds doped with nitrogen-vacancy (NV) centers are a promising non-inductive platform for magnetic resonance spectroscopy, with the ability to operate at low fields and at room temperature. We have addressed the issue of long signal integration times for this platform by etching dense, high aspect ratio nanogratings on the diamond surface which enhance the surface area by a factor of 15. Using a solution of CsF in glycerol, we demonstrate that $4 \pm 2 \times 10^{12}$ ^{19}F spins in a ~ 1 pL volume, can be detected with a signal-to-noise ratio of 3 in 1 s integration [1]. This represents nearly two orders of magnitude improvement in concentration sensitivity over previous NV and picoliter nuclear magnetic resonance (NMR) studies.

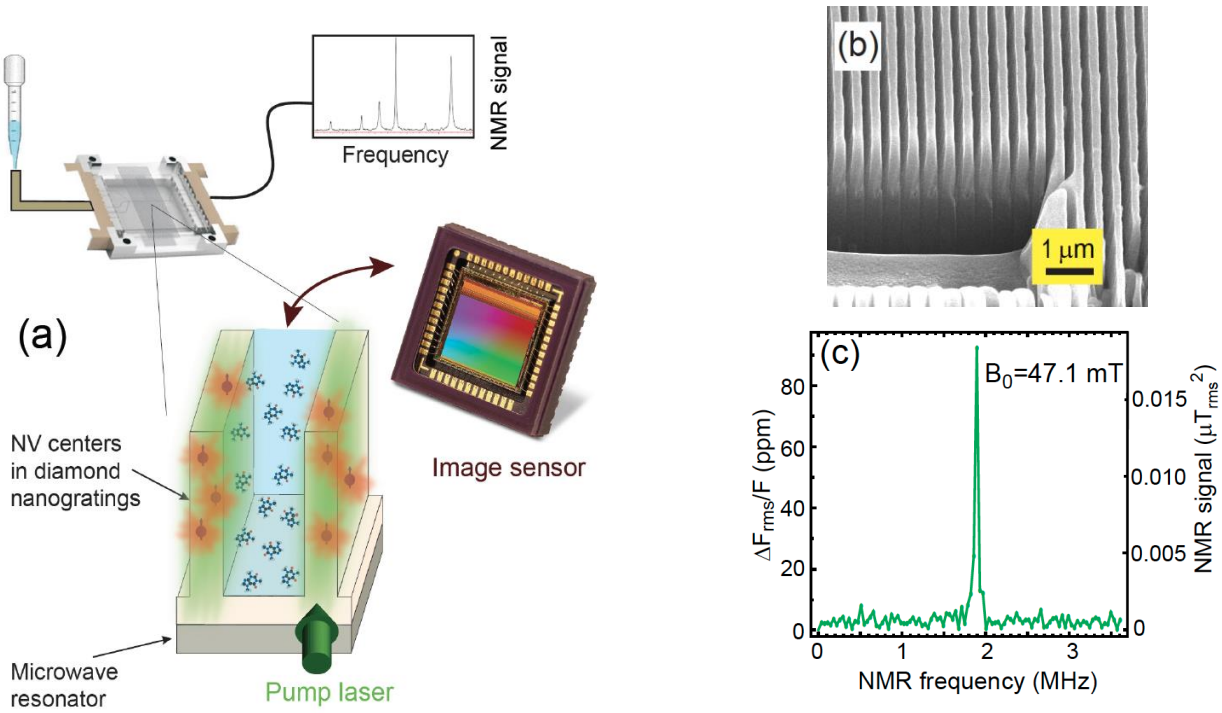

Figure 1: (a) Illustration of the sensor's working principle. (b) Scanning electron micrograph of 400-nm pitch diamond nanogratings. (c) NMR signals for ^{19}F nuclei in Fomblin oil.

1. P. Kehayias, A. Jarmola, N. Mosavian, I. Fescenko, F. M. Benito, A. Laraoui, J. Smits, L. Bougas, D. Budker, A. Neumann, S. R. J. Brueck, V. M. Acosta, *Solution nuclear magnetic resonance spectroscopy on a nanostructured diamond chip*, arXiv:1701.01401 (2017).