Quantum sensing using negatively charged nitrogen-vacancy centers in a 5nm-thin, isotopically enriched ^{12}C diamond CVD layer

K. M. Itoh [1], K. Ohashi [1], T. Rosskopf [2], A. Dussaux [2], M. Loretz [2], Y. Tao [2], R. Schirhagl [2], H. Watanabe [3], J. Ishi-Hayase [1], T. Ishikawa [1,4], S. Shikata [5], and C. L. Degen [2]

[1] *School of Fundamental Science and Technology, Keio University, Yokohama, Kanagawa 223-8522, Japan*

[2] *Department of Physics, ETH Zurich, Schafmattstrasse 16, 8093 Zurich, Switzerland*

[3] *Electronics and Phtonics Research Institute, National Institute of Advanced Industrial Science and Technology (AIST),Tsukuba, Ibaraki 305-8562, Japan*

[4] *Research Center for Advanced Science and Technology (RCAST), The University of Tokyo, Meguro-ku, Tokyo 153-8904, Japan*

[5] *Research Institute for Ubiquitous Energy Devices, National Institute of Advanced Industrial Science and Technology (AIST), Ikeda, Osaka 563-8577, Japan*

Experimental efforts toward detection of magnetic fields originating from single electron spin and/or nuclear spin are attracting much attention. One of the promising approaches is to utilize single nitrogen-vacancy (NV) center in diamond as a sensor. For example, it is expected to be possible to detect a magnetic field originating from a nuclear spin of single proton placed on a surface of the diamond, given that the NV sensing center is placed within the distance of 5 nm. However, intrinsic surface defects of diamond very often do not allow near surface NVs to be in the negatively charged state; the charge state needed to function as a sensor. In order to overcome this difficulty, we have developed a special CVD growth method that allows us to place negatively charged NV centers near the surface [1]. This presentation reports successful introduction of negatively charged NV centers within 5 nm thick diamond epitaxial film and detection of a small number of proton nuclear spins [2] and electron spins [3] situating at the diamond surface.

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