GLOSSARY OF NV-BASED SENSING TECHNOLOGIES*

Magnetometry: change in optically detected magnetic resonance spectra (ODMR) of NV due to change in magnetic field external to NV.

Voltammetry: change of NV fluorescence (change in the NV charge state) due to change in voltage external to NV.

Nano-NMR: change in NV fluorescence due to Larmor precession of a nearby nuclear spin which is manipulated by microwave pulses between initiation and readout of the NV quantum states.

Micro-NMR: change in NV fluorescence due to Larmor precession of an ensemble of the nearby nuclear spins that is manipulated by microwave pulses between initiation and readout of the NV quantum states.

Hyperpolarized ^{13}C-based NMR: change in RF adsorption of ^{13}C nuclei in diamond due to Larmor precession of nearby nuclear spins, where ^{13}C nuclei in diamond are hyperpolarized via polarization transfer from NV centers in diamond.

T1 relaxometry: change in NV relaxation time T1 (time of repopulation of spin $ms_{+/-1}$ states) due to presence of magnetic noise (e.g., paramagnetic species) external to NV.

Nano-thermometry: temperature dependence of NV zero-field splitting observed by ODMR.

pH sensors: NV spin relaxation time is sensitive to the surface charge of NDs that is reversibly affected by pH.

Orientation tracking: ODMR spectrum of NV center is sensitive to an angle between the nitrogen−vacancy (N−V) axis and the direction of an external magnetic field.

Strain sensors: dependence of NV zero-field splitting on diamond lattice strain as observed by ODMR.

- Besides direct measurements of external perturbation in the NV vicinity, diamond nanoparticles hosting NV centers can be used as quantum-enhanced fluorescent labels for imaging/diagnostics:

Background-free fluorescent labels: nanodiamond NV labels with a capability for contrast enhancement with microwave or static magnetic fields to improve imaging sensitivity by utilizing lock-in detection.

Hyperpolarizable MRI labels: nanodiamond NV labels which can be optically hyperpolarized (in a presence of microvawes and low magnetic field) and become visible in MRI (13C channel). Can be also used as dual mode fluorescence/MRI labels.

Multiplexed labels/sensors: nanodiamond NV labels also containing other color centers (e.g. with green and blue fluorescence) providing multiplexed imaging in combination with sensing (via NV) of local environment.

*Glossary generated by panelists of NIH Quantum Workshop, January 2023