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High-Sensitivity Temperature Sensing Using an Implanted Single Nitrogen-Vacancy Center Array in Diamond[1] GUANZHONG WANG, JUNFENG WANG, Department of Physics, University of Science and Technology of China, ADVANCED THINFILM LABORATORY, UNIVERSITY OF SCIENCE AND TECHNOLOGY OF CHINA TEAM — We present a high-sensitivity temperature detection using an implanted single Nitrogen-Vacancy center array in diamond. The high-order Thermal Carr–Purcell–Meiboom–Gill (TCPMG) method was performed on the implanted single nitrogen vacancy (NV) center in diamond in a static magnetic field. We demonstrated that under small detunings for the two driving microwave frequencies, the oscillation frequency of the induced fluorescence of the NV center equals approximately to the average of the detunings of the two driving fields. On basis of the conclusion, the zero-field splitting D for the NV center and the corresponding temperature could be determined. The experiment showed that the coherence time for the high-order TCPMG was effectively extended, particularly up to 108 μs for TCPMG-8, about 14 times of the value 7.7 μs for thermal Ramsey method. This coherence time corresponded to a thermal sensitivity of 10.1 mK/Hz$^{1/2}$. We also detected the temperature distribution on the surface of a diamond chip by using the implanted NV center array with the TCPMG-3. Our approach implies the feasibility for using implanted NV centers in high-quality diamonds to detect temperatures with high-sensitivity and nanoscale resolution.

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