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Optical Characterization of Defects in 4H-SiC for Room Temperature Quantum Sensing

4H-SiC is a host to a wide-range of optically active point defects with outstanding properties such as extremely high brightness and long spin coherence time. These remarkable characteristics make 4H-SiC defects ideal for various quantum applications, including magnetometry, thermometry, and quantum metrology. To investigate its potential for quantum sensing, we conducted a comprehensive study of optically active defects in 4H-SiC. We employed various excitation sources at both cryogenic temperatures and ambient conditions and observed zero phonon line (ZPL) emission peaks in the visible to near IR range. We discuss techniques for creating defects and enhancing their photoluminescence (PL) intensity. Additionally, the influence of crystal orientation on PL at different temperatures is explored. We have also conducted a temperature-dependent study of the previously neglected secondary peaks adjacent to V1 and V1‘ ZPL peaks. Finally, we report on statistical success of room temperature optically detected magnetic resonance (ODMR) scans with silicon vacancy defects in 4H-SiC.

Academic or Professional Status

Graduate Student

Authors: Dr OZTURK, Birol (Morgan State University); Prof. SPENCER, Michael (Morgan State University); Dr MILAS, Peker (Morgan State University); MAHTAB, Sheikh (Morgan State University)

Presenter: MAHTAB, Sheikh (Morgan State University)

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