Point Defects in Materials: A Useful Technique for Quantum Technology

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Abstract

Point defects have emerged as a powerful tool for advancing knowledge and technology. Their influence extends to cutting-edge fields such as quantum technologies, enabling significant findings and driving remarkable scientific progress.

This talk will focus on point defects in wide-band-gap semiconductors as qubits platforms for quantum technologies applications. A roadmap for developing the study of the properties that materials exhibit with defects will be discussed, as well as the use of computational tools such as DFT. Futhermore, a study of the NV center in diamond is included as a guide for the exploration of candidate defects in c-BN. Four defects are investigated in c-BN: N_B with a charge state $+1$ exhibits a doublet ground-state spin. Nevertheless, it is also reported as a color center due to its ZPL of 1.64 eV ($\lambda = 757$ nm). Finally, the three complex defects with neutral charges states exhibits the desired triplet ground-state spin. $V_B - V_N$ reports a ZPL of 0.826 eV ($\lambda = 1503$ nm), $V_B - C_B$ reports a ZPL of 0.933 eV ($\lambda = 1331$ nm), and $V_B - Si_B$ report a ZPL of 1.256 eV ($\lambda = 988$ nm). All these complex defects emit at telecom wavelenghts, making them promising candidates for quantum communication applications.

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