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Diamond Surfaces for Quantum Applications

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Diamonds exhibit remarkable properties at the confluence of biological and quantum sciences. The crystalline carbon lattice of this material acts as both a quantum vacuum, allowing long lived coherent states at room temperature, while also presenting a bio-friendly interface. Point defects in this material are now being used for an ever expanding array of quantum information and sensing applications, including live intra-cellular biosensing. However the diamond surface, including its typical termination structure, is to date poorly controlled or understood. This seriously compromises the quantum properties of near-surface point defects (qubits), limiting the applicability of this system. I will present our use of the full capabilities of the soft x-ray spectroscopy beamline, in conjunction with DFT-driven simulations and CVD-based diamond synthesis, to create, modify and probe diamond surfaces. This has allowed us to begin understanding and eliminating surface states and structures, which interfere with diamond's otherwise superlative materials properties. In doing so we have created novel surface chemistries, found unexpected surface crystalline defects (including air-stable dangling bonds) and optimized the production and processing steps required to create high-performance diamond devices for a variety of applications. I will also give an overview of the various associated diamond defect applications we are pursuing, including wide-field magnetic and thermal imaging, bio-sensing and 2-D materials characterization.

Keywords or phrases (comma separated)

Diamond, NEXAFS, Surfaces

Are you a student?

No

Do you wish to take part in</br>the Student Poster Slam?

Are you an ECR? (<5 yrs</br>since PhD/Masters)

Yes

What is your gender?

Male

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