Advances in Blue Wave HFCVD and Microwave Plasma CVD Systems: Advanced Instrumentation and Emerging Applications of CVD diamond Coatings and Devices.

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Abstract

Blue Wave Semiconductors is emerging as an innovative equipment manufacturing company to supply CVD Diamond coating systems for research and development market. CVD diamond is currently a forefront of materials technology due to demonstration of variety of applications towards quantum technologies, radiation hard electronics and photonics, detectors, sensors, and mechanical applications. Due to demand for customized CVD diamond systems, we have put a lot of effort into developing the hot filament chemical vapor deposition tool and compact microwave plasma CVD systems for synthesizing diamond coatings for various applications. We have designed and developed various chamber geometries for hot filament and microwave-based plasma systems creating chemical vapor deposition processes in a single processing chamber to efficiently deposit epitaxial, microcrystalline, nanocrystalline CVD diamond coatings for variety of applications. We will present our systematic study on identification of various processing parameters, process optimization on growth undoped and doped diamond system towards radiation hard devices to protective coatings. Our unique designs and system performance towards emerging applications will be highlighted. Selective examples of applications of HFCVD and new generation compact microwave plasma systems that played a great role in application and device developments such as NV center defects in diamond films, nanocrystalline, polycrystalline and their admixture films fabricated using a hot filament chemical vapor deposition (HFCVD) system for H^- stripping and MEMs applications. We will discuss optimization of process to achieve high purity diamond foils on patterned silicon substrates with manageable intrinsic and thermal stresses so that they can be released as free-standing foils without curling. An *in-situ* laser reflectance interferometry tool (LRI) is used for monitoring the growth characteristics of the diamond thin film materials. The integrated LRI and HFCVD process provides real time information on the growth of films and can quickly illustrate growth features and control film thickness. These results will be discussed in the light of development of nanodiamond foils for MW proton beam power application.