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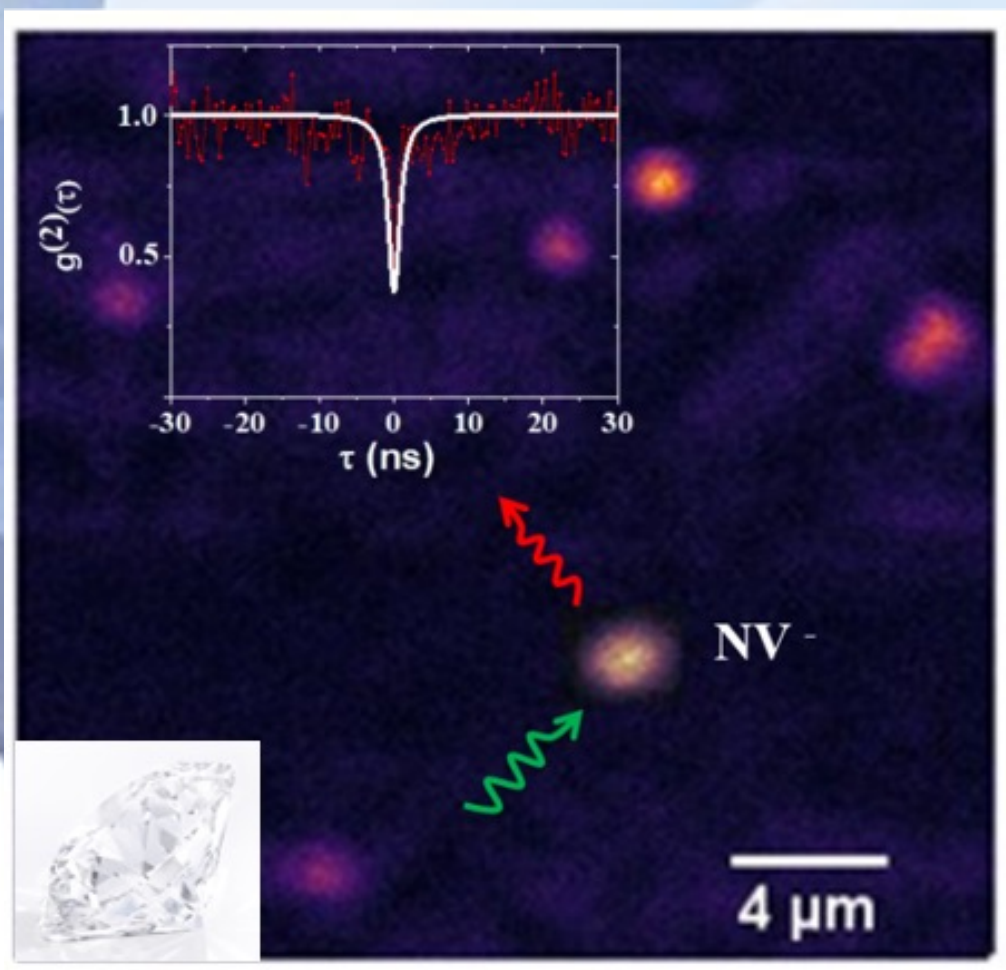

The advancement in the development of microwave plasma chemical vapor deposition (MPCVD) technology lead to the synthesis of large-area electronic grade single crystal diamond (SCD). Various applications of CVD diamond such as, quantum emitters, magnetometry, optical imaging, high temperature electronic devices and gem applications are being explored. Colorless SCD crystals are produced by MPCVD technology for gem applications with average size (10-12 carat), which is cost effective, compared to mine natural diamond. Large-area (~20 mm × 20 mm) SCDs have been grown homoepitaxially on (100) oriented CVD diamond substrates by incorporating nitrogen (1-10 ppm) and boron (3 ppm) impurities. The nitrogen addition in the feed gas is advantageous in microscopic smoothing of surface roughness and the suppression of hillocks or uneven growth of diamond. The nitrogen-vacancy (NV) centres in SCD acts as an individual quantum emitter in solid-state system, which have potential applications in quantum technology, magnetometry and optical imaging.

Dr. Padmnabh Rai

UM-DAE Centre for Excellence in Basic Sciences

Single crystal diamond for quantum and industrial applications

Dr. Padmnabh Rai is currently holding the position of Reader-F in School of Physical Sciences, UM-DAE Centre for Excellence in Basic Sciences, Mmbai-400098. He has completed his PhD degree in Condensed Matter Physics from IIT Bombay. Dr. Rai has also served as an Assistant Professor (UGC) in the Department Physics and Astronomical Sciences, Central University of Himachal Pradesh (HP). Before holding the academic position in India, he worked as a postdoctoral fellow from the National University of Singapore and the University of Bourgogne (France).

Dr. Rai is currently working on synthesizing carbon-based materials (single-crystal diamond, carbon nanotube, and graphene) and their potential applications in plasmonics and nano-scale optics. Dr. Rai is also involved in teaching physics courses at graduate and undergraduate levels. He has consulted industries in India to develop a laboratory for growing single-crystal diamond for gem and scientific applications.

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