Engineering coherent defects in diamond for quantum technologies

UC SANTA BARBARA Quantum Foundry DMR-1906325

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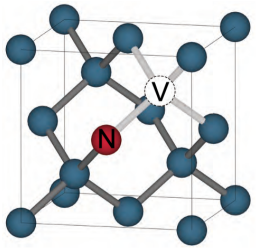
UC SANTA BARBARA MATERIALS

Diamond: a host for NV centers

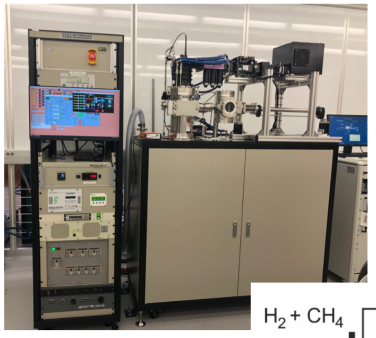


Interested in applications involving:

(1) Quantum sensing with single, shallow NVs

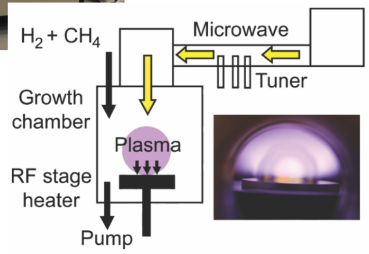
(2) NV ensemble-based explorations of many body dynamics

CVD growth allows for pristine control



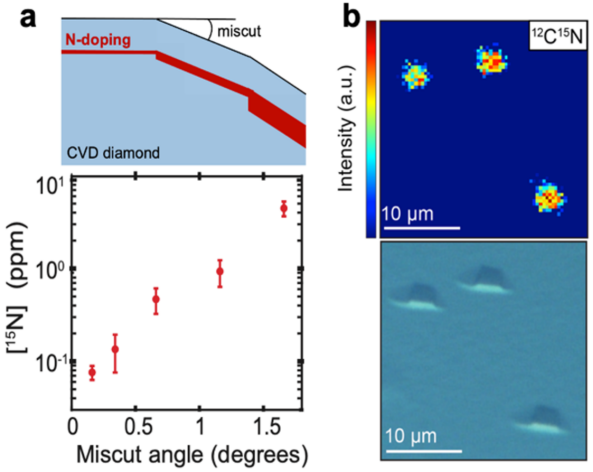
- High-quality homoepitaxy
- Isotopic purification
- Dopant incorporation

Recently commissioned new PE-CVD tool through the Quantum Foundry.

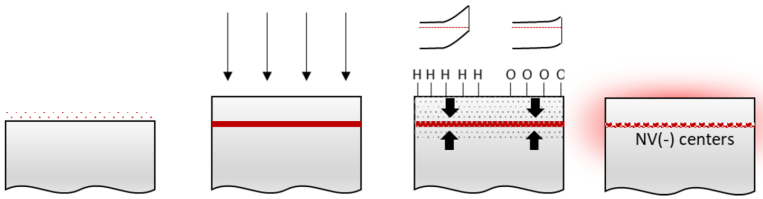


Understanding NV center creation

Probing nitrogen incorporation via *in-situ* doping during growth.



Post-growth formation enhancement involves many processes.

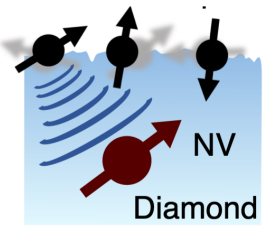
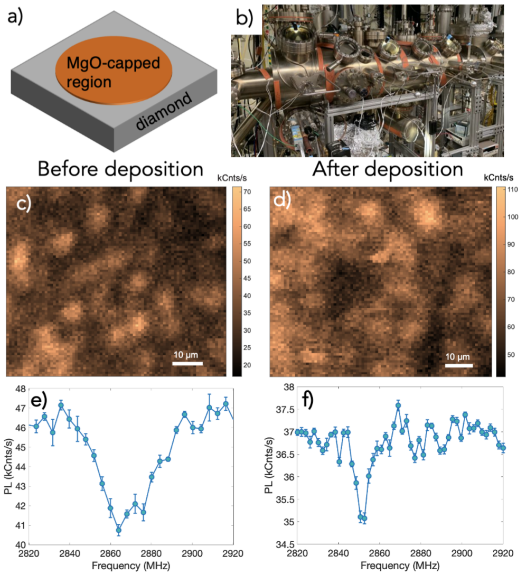


- ^{15}N doping during CVD
- electron irradiation
- surface termination
- high temp. annealing

Stabilizing the diamond surface

Capping layers may:

- protect from surface decoherence
- lock-in a desired NV–adsorbate complex.



MgO encapsulation preserves NV properties.