

Reflections on the first year of PLD of HTS thin films



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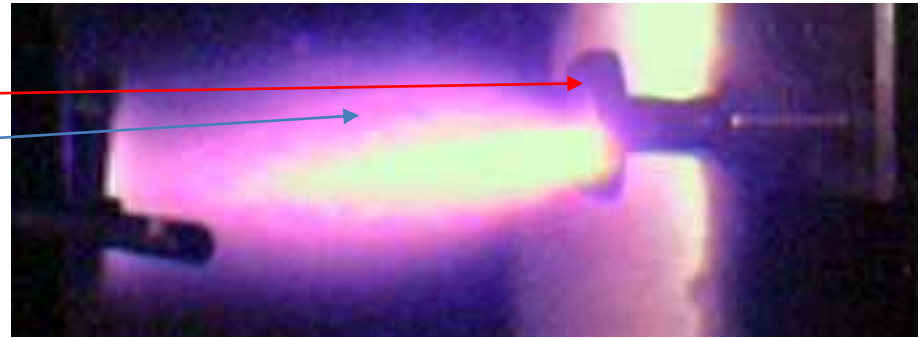
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Reminiscences from the first year of PLD of HTS thin films 1987-1988

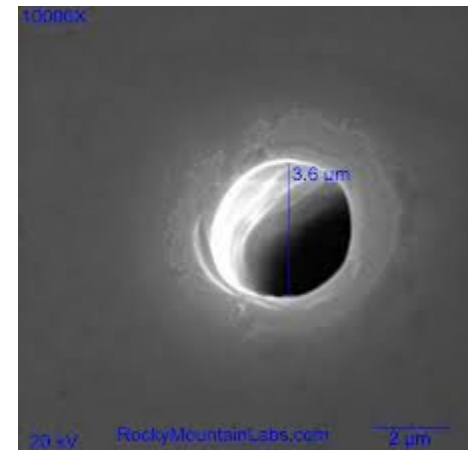
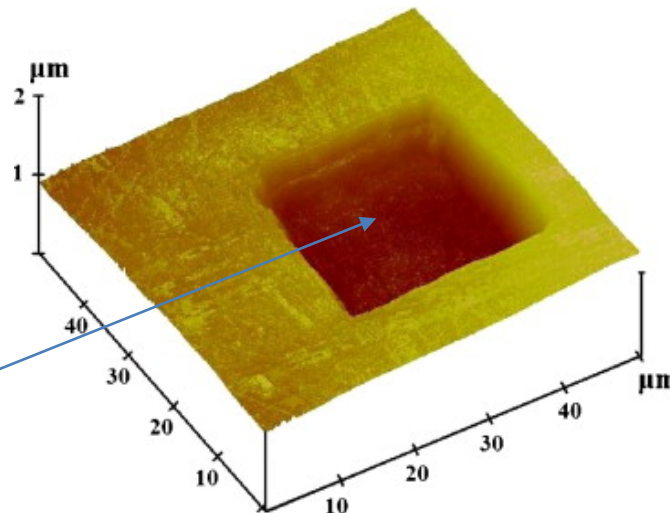
Preparation of the high temperature superconducting (HTS) thin films by pulsed laser deposition (PLD)

- 1-2-3 YBCO ceramic target on the right side
- pinkish plume



- Prior to 1987, I was working in UV laser ablation for etching of polymers & solids

The plume looks similar to the above, but the end result is a via-hole in the solid samples



Moving from etching to deposition (1987-8)

- Since the UV laser ablation process was familiar to me, I moved quickly to deposition of HTS thin films by PLD
- It was easy to prepare ceramic films by PLD at low temperature and a post annealing process
- First, we wished to have *in-situ* annealing – necessitates 700-800 °C heater blocks (the stoichiometry of the 1-2-3 YBCO was preserved, since it is a stable phase) [even 2-1-1 yields 1-2-3 in PLD...]
- The second challenge was not to lose the YBCO phase or to stabilize it during the deposition process – Oxygen role - below ~5-10 mTorr O₂ pressure, the 1-2-3 YBCO loses its stoichiometry due to Cu₂O evaporation loss – it is very volatile
- Venky's paper: APL 52, 754 (1988) – used 5 mTorr & post annealing
- Our paper: APL 53, 2330 (1988) – used 100 mTorr & *in-situ* anneal.
- Epitaxiality - lattice mismatch – SrTiO₃, LaGaO₃, NdGaO₃, LaAlO₃.....
Work done in IBM Research, Yorktown, NY, 1989 →

My sabbatical in the IBM Research lab, Yorktown Heights, NY, 1988-9



- I brought the PLD technique, that was developed at the Technion, to the IBM Research lab (I was working in the group of Arunava Gupta)
- Work on epitaxiality and smoothness of the films versus the laser-wavelength, was done there.
- One day we had a visitor from Bellcore, Venky Venkatesan. He told us he was very relieved to see our APL paper on PLD from 1988, since this removed doubts in his own work, as people complained to him that they could not reproduce his results... (I guess this was due to the 5 mTorr deposition in that paper)