

Thickness dependence of critical current density in thick MgB₂ films

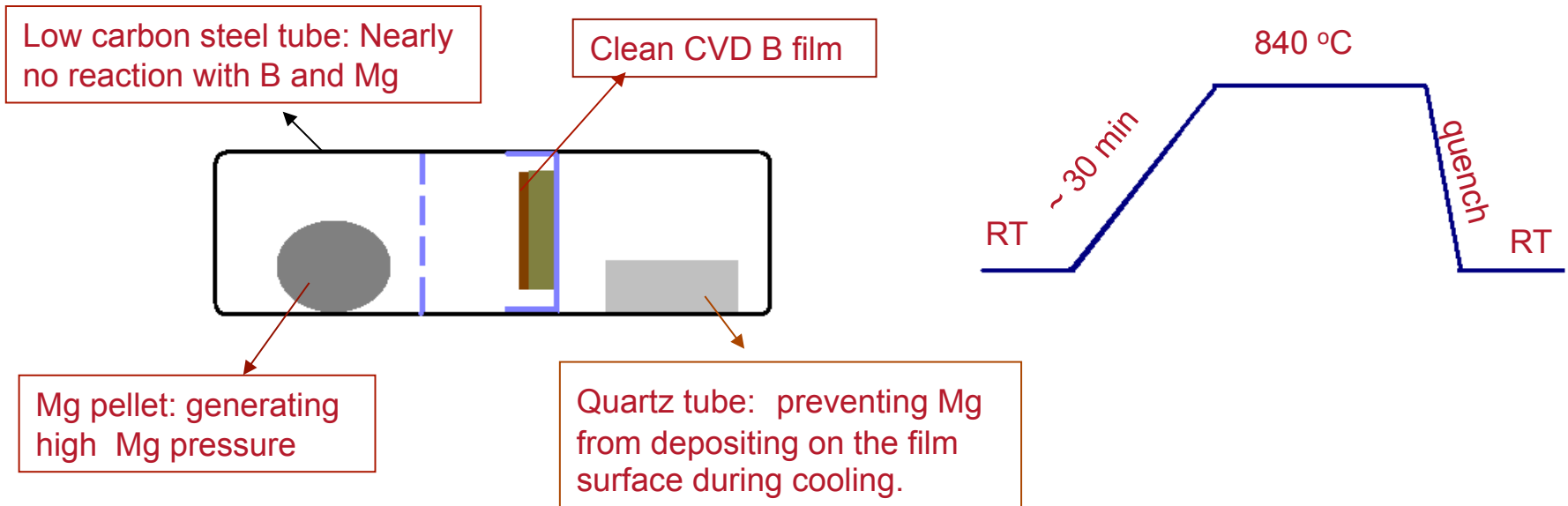
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Ex Situ High Temperature Annealing CVD-Grown B Films in Mg Vapor

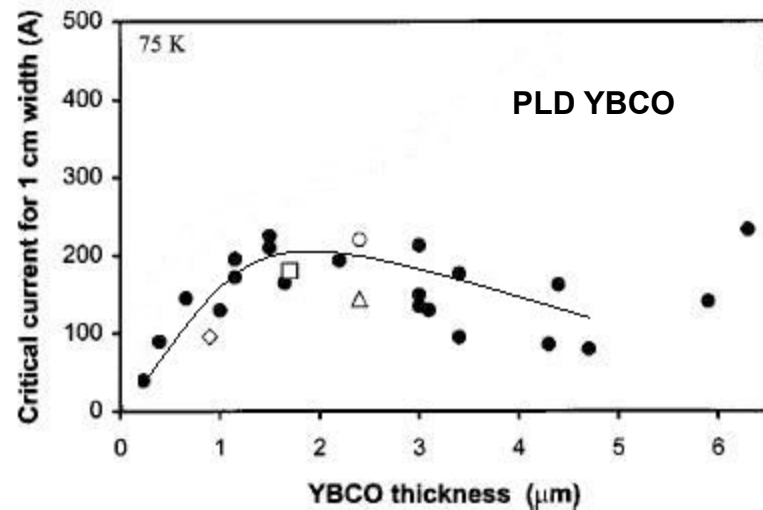
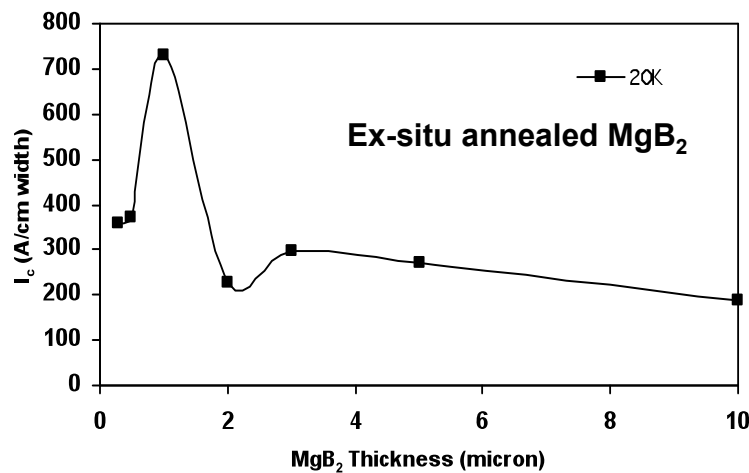
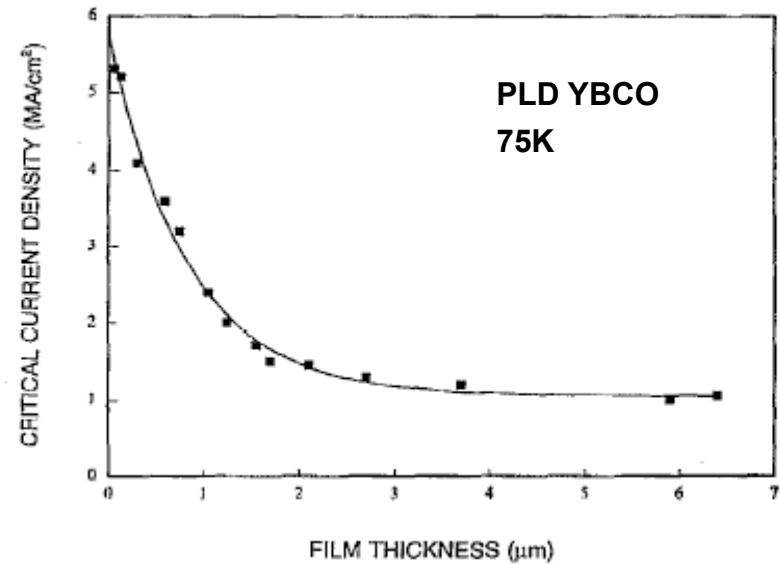
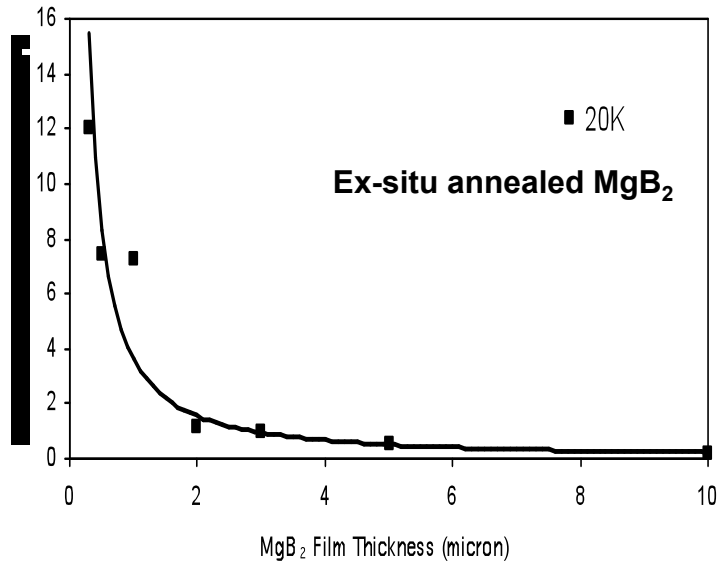


Results of MgB₂ Films Fabricated for Thickness Dependence Study (*Ex Situ* Annealed at 840°C)

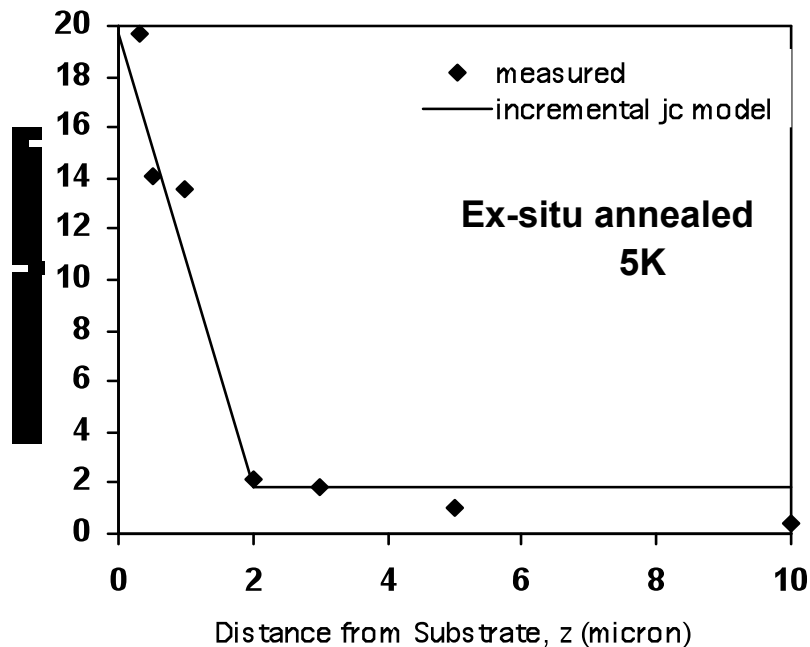
| MgB ₂ film thickness (μm) | J_c (A/cm ²) @ 0T,5K | J_c (A/cm ²) @ 0T,20K | I_c (A/cm-w) @ 0T,5K | I_c (A/cm-w) @ 0T,20K |
|--------------------------------------|------------------------------------|-------------------------------------|------------------------|-------------------------|
| 0.3 | 1.97×10^7 | 1.2×10^7 | 591 | 360 |
| 0.5 | 1.41×10^7 | 7.42×10^6 | 705 | 371 |
| 1 | 1.36×10^7 | 7.28×10^6 | 1360 | 728 |
| 2 | 2.1×10^6 | 1.14×10^6 | 420 | 228 |
| 3 | 1.79×10^6 | 9.94×10^5 | 537 | 298 |
| 5 | 1.03×10^6 | 5.41×10^5 | 515 | 270 |
| 10 | 3×10^5 | 1.9×10^5 | 387 | 190 |

Hanna *et al*, Accepted for publishing in SC Sci. Tech.

J_c and I_c Thickness Dependence (MgB_2 versus YBCO)

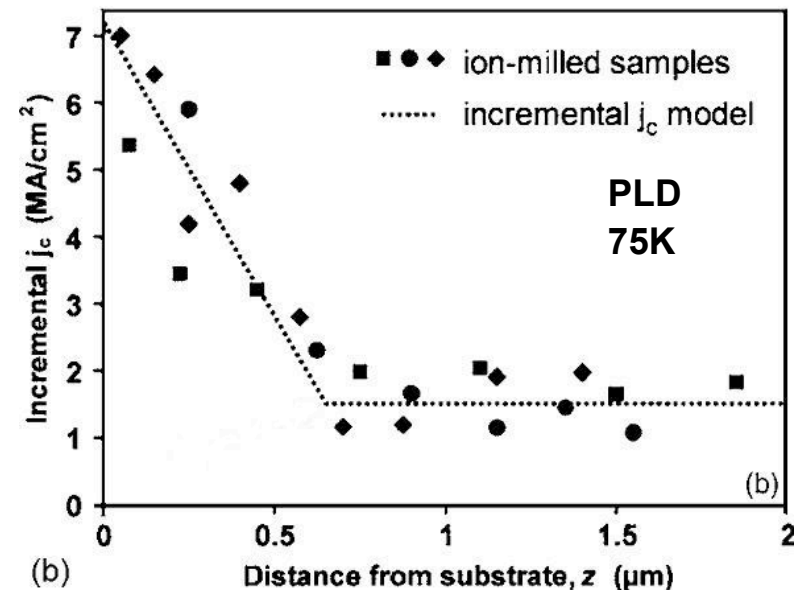


Incremental J_c Model (MgB2 vs. YBCO)



MgB2

Hanna *et al*, Accepted for publishing in SC Sci. Tech.



YBCO

Foltyn *et al*, 2005 Appl. Phys. Lett. 87 162505

Possible Explanations for J_c and I_c Drop with Increasing Thickness

- High density of flux pinning defects and dislocations near the film-substrate interface
- Vortices: as thickness t is increased, the Lorentz force, which is proportional to t , can only stay in balance with pinning forces by reducing J_c
- Microstructural degradation (cracks, porosity)
- Impurity diffusion during annealing

Thank You

