Improved performance of CSD-grown $Y_xGd_{1-x}Ba_2Cu_3O_7$-$BaHfO_3$ nanocomposite films on Ni5W substrate

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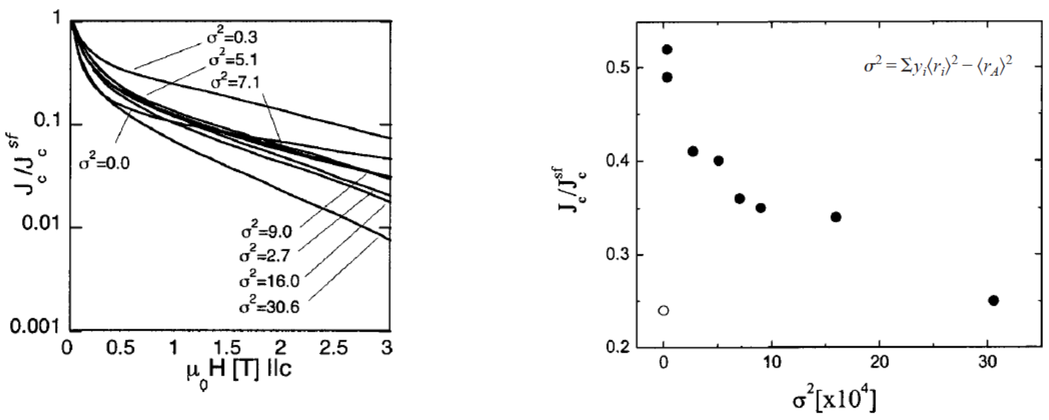
Motivation

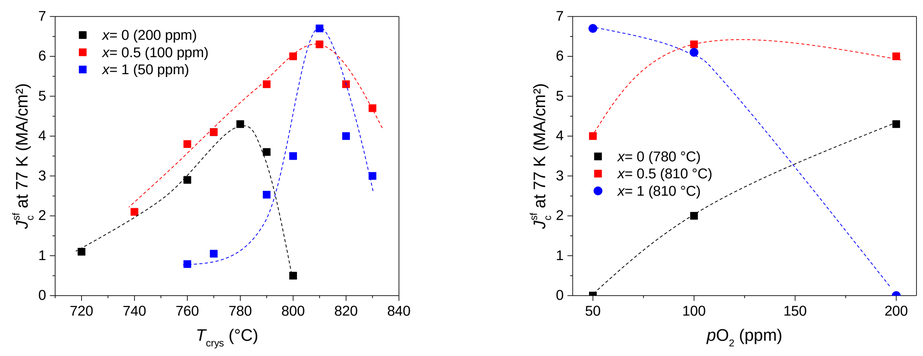
- Combination of pinning mechanisms
  - Δl pinning: atomic disorder *RE-RE*‘ or *RE*-Ba (variation in mean free path)
  - ΔT_c pinning: small clusters vs. larger areas of different *RE*BCO (localized strain vs. local changes of T_c).
- Improved pinning performances under magnetic fields



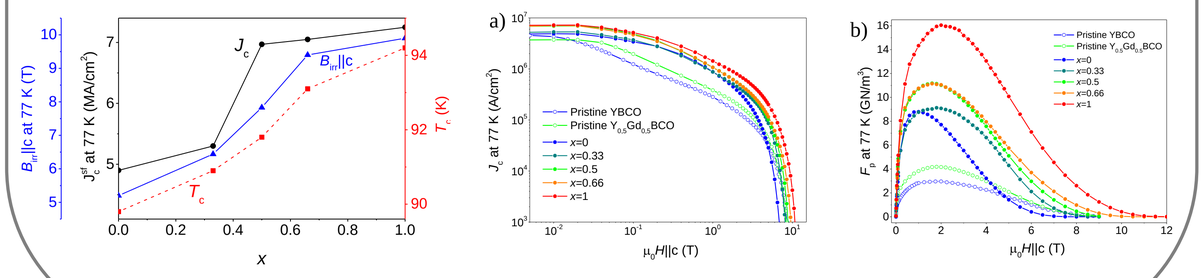
J. L. MacManus-Driscoll *et al.*, *Appl. Phys. Lett.* 84, 5329–5331 (2004)

Previous work

- Wider growth parameter windows.



- Strong $J_c(B)$ and $F_p(B)$ improvement for the optimized YGBCO+12%BHO films in comparison with pristine YBCO and $Y_{0.5}Gd_{0.5}BCO$ films.



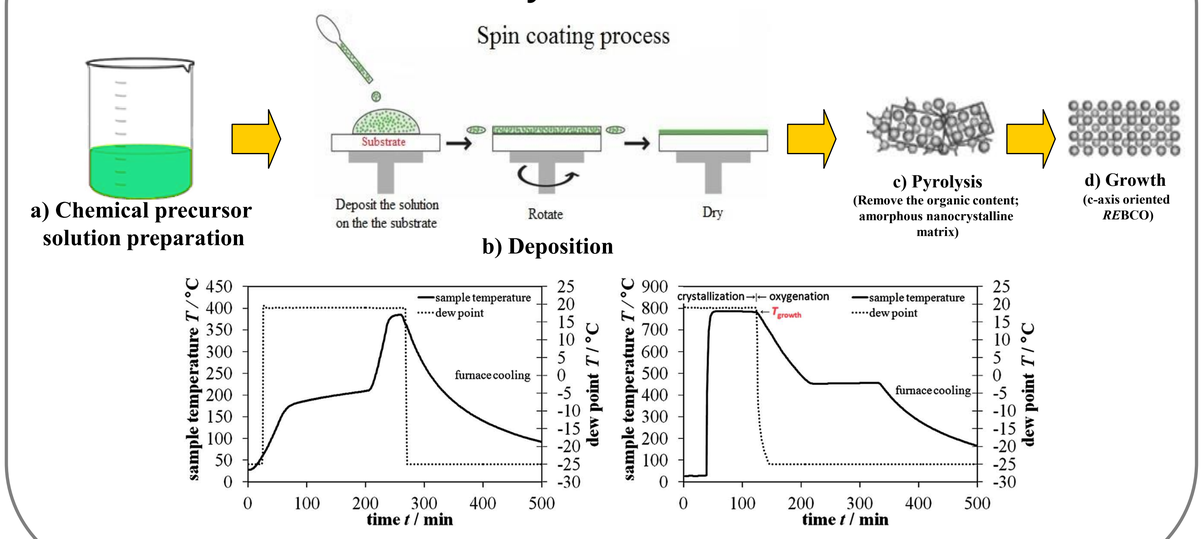
P. Cayado *et al.*, RSC Adv., 2018, 8, 42398-42404

Conclusions

- Epitaxial YGBCO+12%$BaHfO_3$ films were grown on both Ni5W and IBAD substrates. Better properties on Ni5W.
- Clear improvement of superconducting properties with Gd content *x*. Reduction of $BaCeO_3$ formation could explain this tendency.
- Transport measurements show an increase of J_c and F_p with *x*. Joint effect of $BaHfO_3$ particles and better crystalline properties.
- TEM images show particles homogeneously distributed and randomly oriented in the YGBCO matrix.

Film preparation

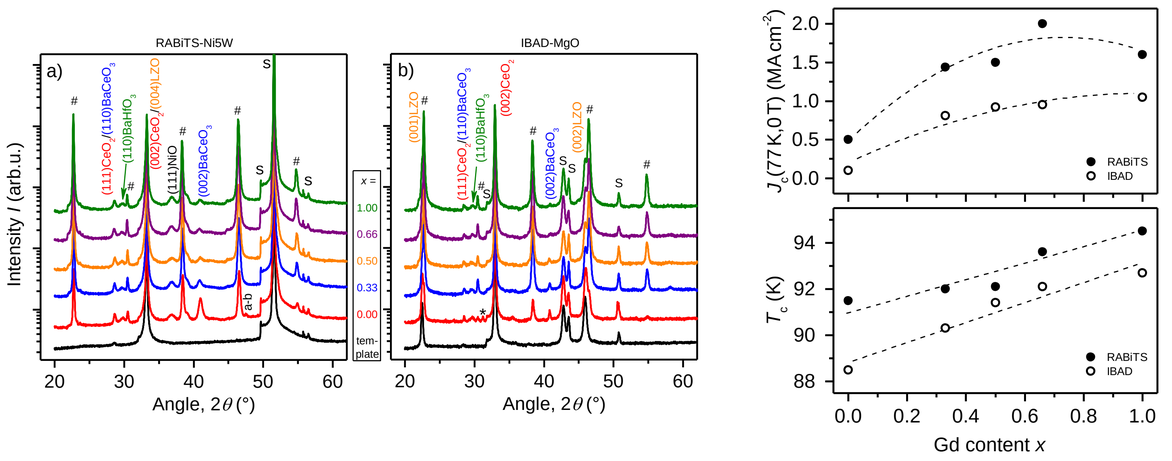
- CSD: TFA route + Acetylacetone



M. Erbe *et al.*, J. Mater. Chem. A 2, 4932 (2014).

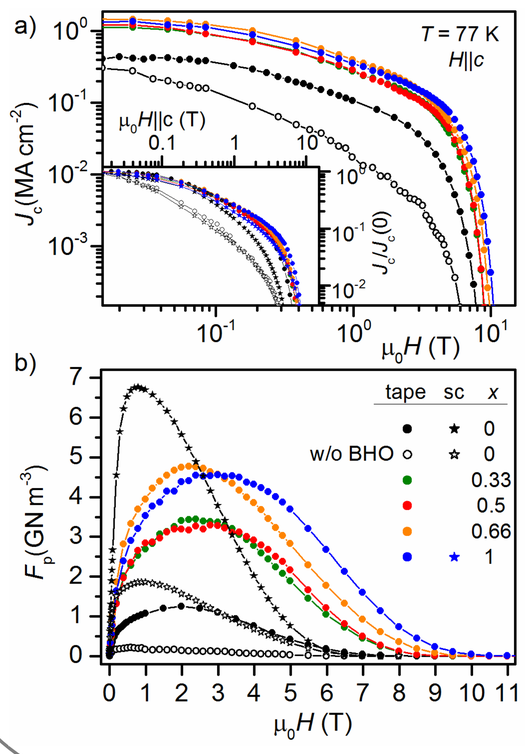
Properties on Ni5W

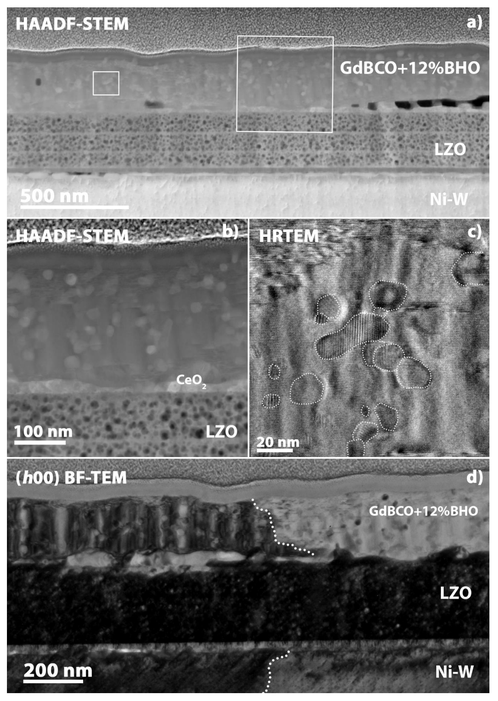
- Areal intensity of (00*l*)YGBCO increases with *x*. $BaCeO_3$ formation seems to decrease with *x*.
- General tendency for both T_c and inductive J_c^{sf} at 77 K to increase with *x*. Better properties on Ni5W.



P. Cayado *et al.*, CSD-grown $Y_{1-x}Gd_xBa_2Cu_3O_{7-\delta}$-$BaHfO_3$ nanocomposite films on Ni5W and IBAD technical substrates (submitted)

- Clear improvement in J_c and F_p due to BHO nanoparticles as well as Gd content *x*.
- Dense YGBCO+$BaHfO_3$ films of homogeneous thickness on top of the buffer layers. High density of randomly oriented and homogeneously distributed particles in the matrix.





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