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
  - $\Delta I$ pinning: atomic disorder $RE$-$RE'$ or $RE$-Ba (variation in mean free path)
  - $\Delta T_c$ pinning: small clusters vs. larger areas of different $REBCO$ (localized strain vs. local changes of $T_c$).

- Improved pinning performances under magnetic fields

![Graph](image1)

- $J_c(B)$ 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.

![Graph](image2)

**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.

![Graph](image3)

**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

- Spin coating process

- Chemical precursor solution preparation

- Deposition

**Properties on Ni5W**

- Areal intensity of (00)YGBCO increases with $x$. BaCeO$_3$ formation seems to decrease with $x$.
- General tendency for both $T_c$ and inductive $F_p$ at 77 K to increase with $x$. Better properties on Ni5W.

![Graph](image4)

- 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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