

# Microstructure and superconducting properties of high-rate PLD-derived $\text{GdBa}_2\text{Cu}_3\text{O}_{7-\delta}$ coated conductors with $\text{BaSnO}_3$ and $\text{BaZrO}_3$ pinning centers

Alexey V. Ovcharov<sup>1</sup>, Pavel N. Degtyarenko<sup>2,3</sup>, Vsevolod N. Chepikov<sup>2,4</sup>, Alexander L. Vasiliev<sup>1,5,6,\*</sup>, Sergey Yu. Gavrilkin<sup>7</sup>, Igor A. Karateev<sup>1</sup>, Alexey Yu. Tsvetkov<sup>7</sup>, and Andrey R. Kaul<sup>2,4</sup>

<sup>1</sup>National Research Center "Kurchatov Institute", Moscow, 123182, Russia

<sup>2</sup>SuperOx, Moscow, 117246, Russia

<sup>3</sup>Joint Institute for High Temperature of Russian Academy of Sciences, Moscow, 125412, Russia

<sup>4</sup>Lomonosov Moscow State University, Moscow, 119991, Russia

<sup>5</sup>Shubnikov Institute of Crystallography of Russian Academy of Sciences, Moscow, 117333, Russia

<sup>6</sup>Moscow Institute of Physics and Technology (State University), Dolgoprudny, Moscow Region, 141701, Russia

<sup>7</sup>P.N. Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, 119991, Russia

\*a.vasiliev56@gmail.com

## Content:

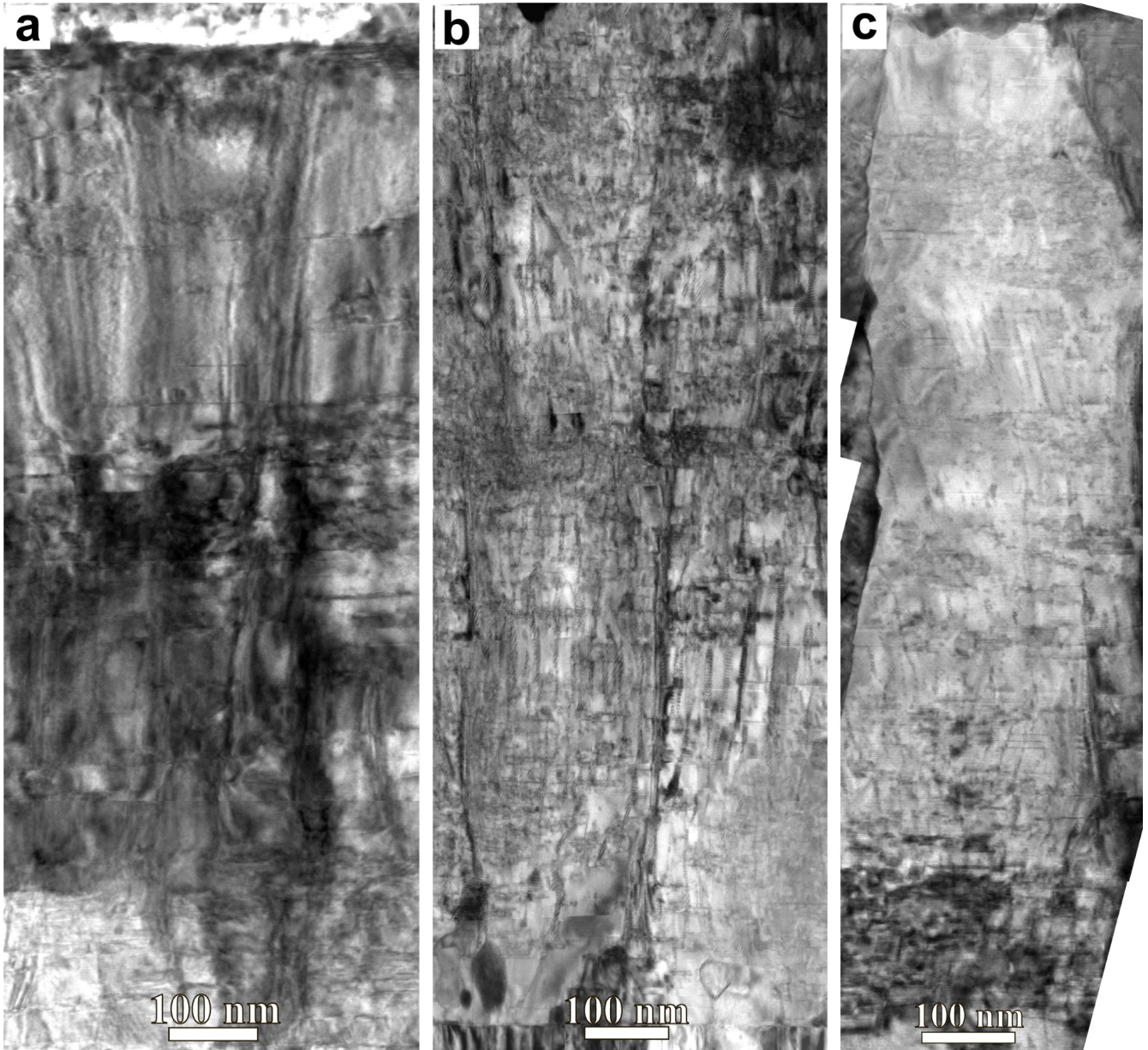
**Figure S1.** TEM cross-section overall images of samples.

**Figure S2.** HR TEM plan-view image of the BSO sample and the Fourier filtered images.

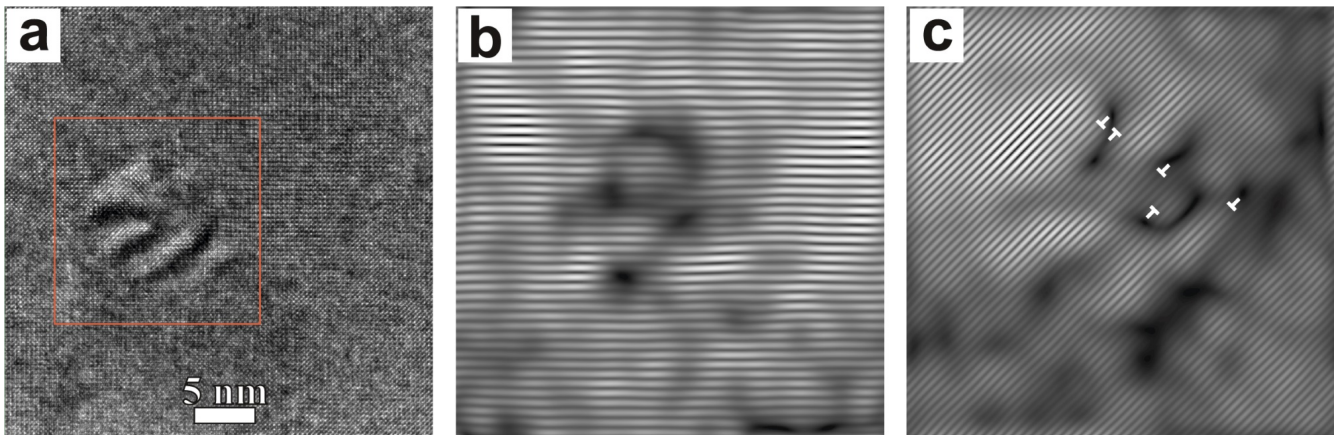
**Figure S3.** Temperature dependence of resistivity for reference and doped samples.

**Figure S4.** Field dependence of pinning force for doped samples in field  $\mathbf{B}||c$  at 77 K.

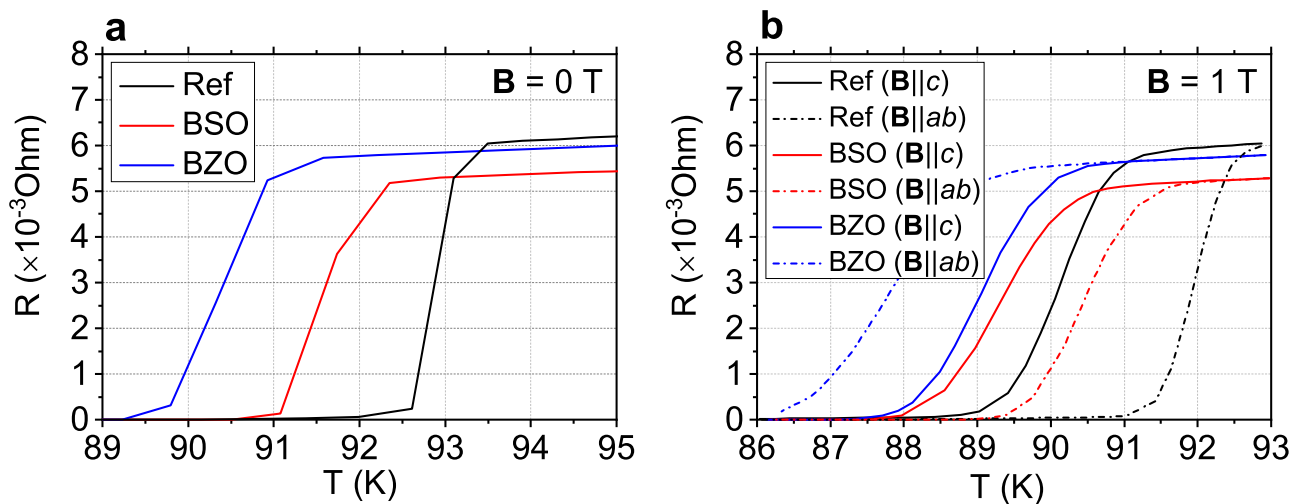
**Figure S5.** Schematic layer-by-layer architecture of the samples.



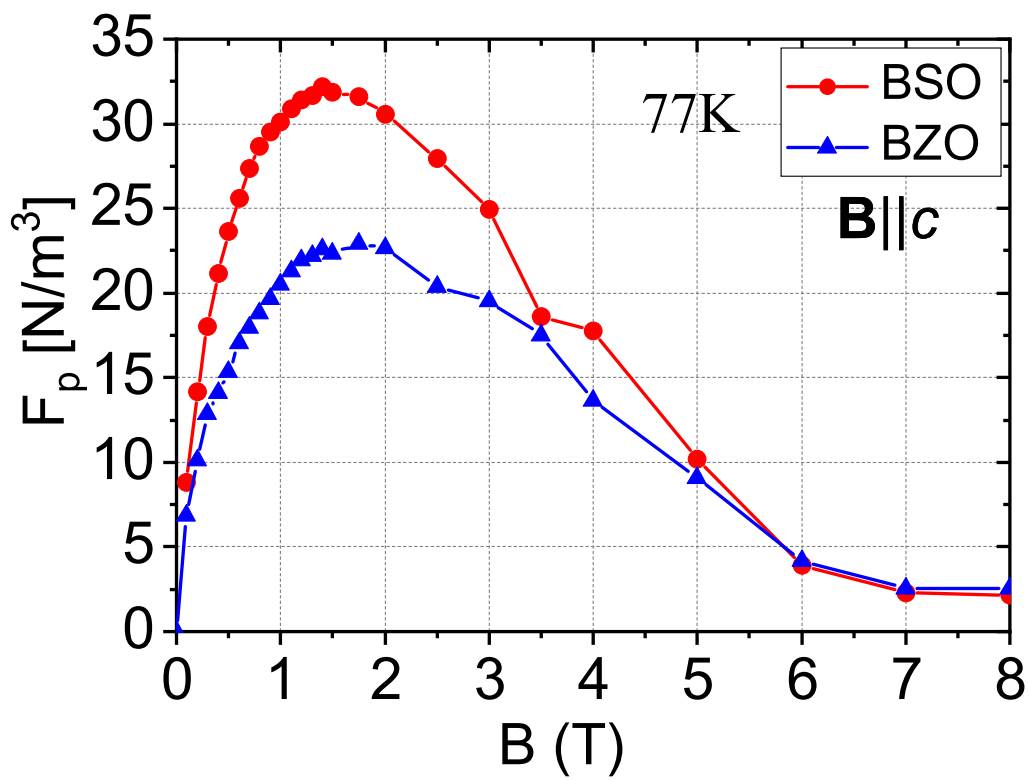
**Figure S1.** TEM cross-section overall images: (a) reference sample, (b) 6% BSO sample, (c) 6% BZO sample.



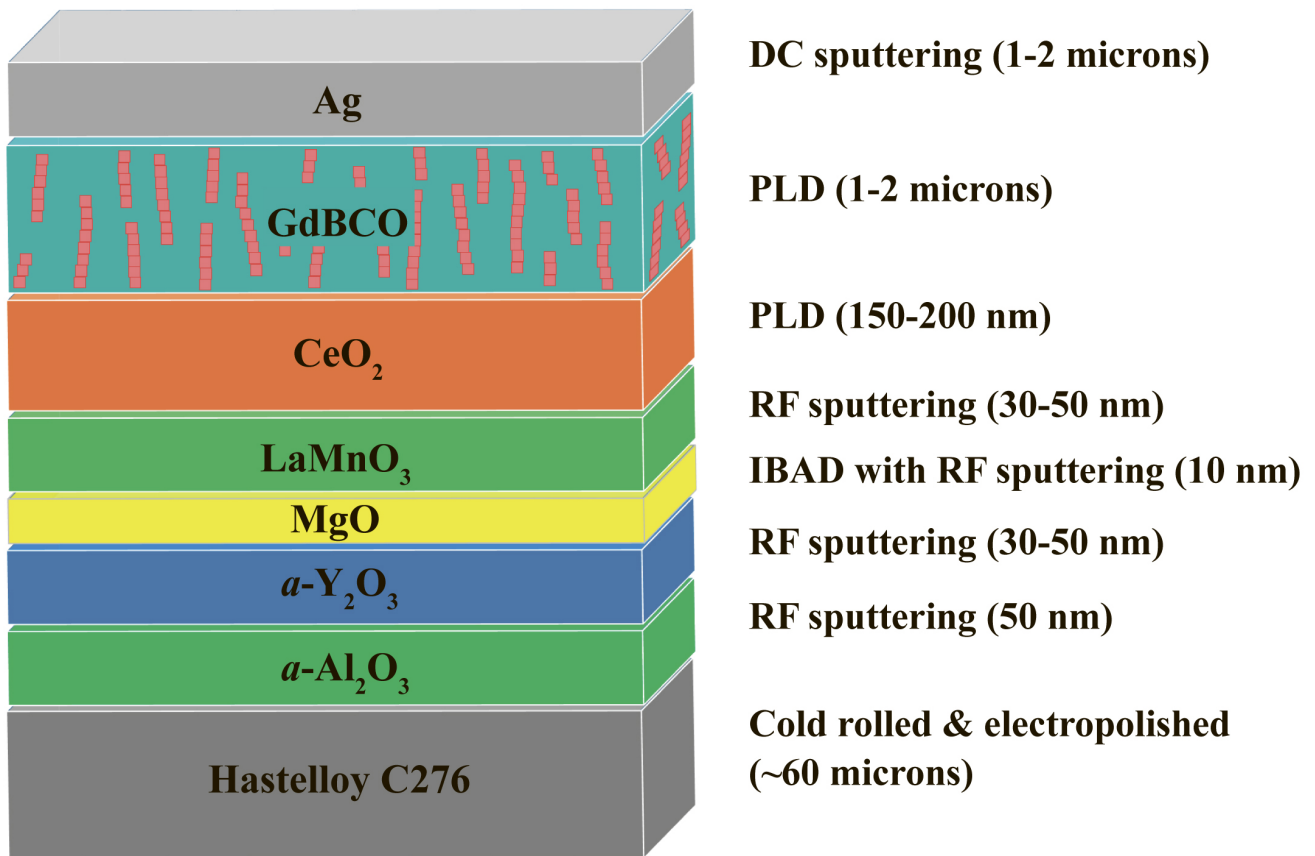
**Figure S2.** (a) HR TEM plan-view image of the BSO sample and the Fourier filtered images of selected area marked by red square and obtained from the reflexes: (b)  $100_{GdBCO}$  and  $010_{BSO}$ , (c)  $110_{GdBCO}$  and  $\bar{1}10_{BSO}$ . Extra crystal planes are marked by  $\perp$ .



**Figure S3.** Temperature dependence of resistivity for reference and doped samples. (a) – without applied magnetic field. (b) – at 1 T  $B||c$  – solid curves,  $B||ab$  – dash curves.



**Figure S4.** Field dependence of pinning force for doped samples in field  $\mathbf{B}||c$  at 77 K.



**Figure S5.** Schematic layer-by-layer architecture of the samples. The superconducting layer contains artificial pinning centers that marked as coral nanocolumns.