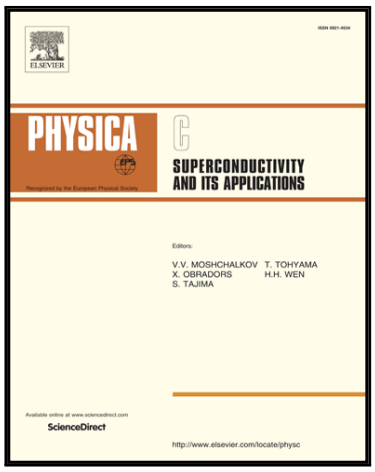

Control of in-field performance of 25 mol.% Zr-added REBCO superconductor tapes

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Highlihts

- A promising approach for manufacturing of advanced functional materials for energy applications involves the spontaneous growth of self-assembled nanostructures in thin films.
- In the case of state-of-the-art $REBa_2Cu_3O_{7-\delta}$ (REBCO and RE=Gd, Y) superconductors, introduction of self-assembled $BaZrO_3$ (BZO) nanorods significantly improves their performance in applied magnetic fields. Chemical composition of REBCO and its lattice parameter mismatch relative to BZO have been found to play a significant role in this respect.
- In this study, the relation between the c-axis lattice parameter of REBCO films with 25 mol.% Zr addition and the critical current density (J_c) was investigated at (77 K, 0 T), (30 K, 3 T (B||c)), and (30 K, 9T (B||c)).
- An increase in REBCO c-axis lattice parameter and a decrease in elastic mismatch strain relative to self-assembled BZO nanocolumns were observed with increasing (Ba+Zr)/Cu content.
- The reduction in elastic mismatch strain was found to be the driving force behind the growth of the desired continuous self-assembled BZO nanocolumns along the entire film thickness which in turn led to an improvement of in-field J_c at 30 K.
- The optimum c-axis lattice parameter for achieving the highest J_c in magnetic field was found to be temperature and field dependent, with optimum values of 11.74, 11.76 and 11.78 Å at (77 K, 0 T), (30 K, 3 T (B||c)), and (30 K, 9T (B||c)), respectively.