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The growth mechanism of pinning-effective nanostructures embedded in $YBa_2Cu_3O_{7-x}$ (YBCO) superconducting thin film A. GAPUD, A. KHAN, M. PARANTHAMAN, Univ. of South Alabama, D. CHRISTEN, Oak Ridge Natl. Lab. — Following up on previous success in modifying the pulsed-laser-deposition (PLD) film processing to introduce self-assembled pinning defects in films of various high-temperature superconductors (HTSC), specifically the case of self-assembled columnar arrays of oxide nanodots in $YBa_2Cu_3O_{7-x}$ (YBCO) thin film [*Superconductor Science and Technology* **18**, 1533 (2005)] using a nanodot-doped YBCO target, a careful and systematic examination of the growth mechanism is yet to be conducted on this and similar systems. This study examines (1) how the oxide nanodots retain their character during the deposition and (2) how the nanodots both influence, and are influenced by, the local potential-energy landscape that promotes spontaneous assembly into coherent stacks. This is done by growing the film subject to slight variations in the processing parameters which may influence the nature of the heterogeneity of any given layer in the film. Particular attention is paid to the influence of varying laser-pulse frequency which determines the time duration by which the potential-energy landscape of a pulsed layer is consolidated in time for the next pulsed layer. The mechanism is also tested for a system in which the embedded nanostructures are made from a non-oxide material (gold). Results consist of microstructure (cross-sectional HRTEM, XRD, surface SEM), transport properties (critical temperature and critical current), and magnetic susceptibility.

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