

Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Strong pinning of vortex lines by nanoparticles¹ ALEXEI KOSHELEV, Materials Science Division, Argonne National Laboratory, ALEJANDRO KOLTON, Centro Atómico Bariloche and Instituto Balseiro, Argentina — Pinning of vortex lines by array of nanoparticles embedded inside superconductors became the most efficient practical way to achieve high critical currents. In this situation pinning occurs via trapping of the vortex-line segments and the critical current is determined by the typical length of trapped segment. To verify analytical estimates and develop a quantitative description of strong pinning, we use large-scale numerical simulations. We study the dependence of the critical force on the density of pins in the regime of independently pinned lines, statistical properties of trapped lines, and suppression of the apparent critical force by thermal fluctuations.

¹This work is supported by the Center for Emergent Superconductivity funded by the U.S. DOE, Office of Science, under Award No. DE-AC0298CH1088.

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Date submitted: 14 Dec 2010

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