Abstract Submitted
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Optimization of vortex pinning by nanoparticles using numerical simulations[1] ALEXEI KOSHELEV, IVAN SADOVSKYY, Materials Science Division, Argonne National Laboratory, CAROLYN PHILLIPS, Mathematics and Computer Science Division, Argonne National Laboratory, ANDREAS GLATZ, Materials Science Division, Argonne National Laboratory and Northern Illinois University — Vortex pinning by self-assembled nanoparticles has been established as an efficient route to enhance current-carrying capability of practical superconductors. We explore vortex pinning by randomly distributed metallic spherical nanoparticles using large-scale numerical simulations of time-dependent Ginzburg-Landau equations. We found optimal size and density of particles at which the highest critical current realizes for fixed magnetic field. For every particle size the critical current reaches maximum value at certain particle density, typically corresponding to 15-22% of the volume fraction filled by the particles, which is close to the percolation concentration. This optimal particle density increases with the magnetic field. We also found that the optimal particle diameter is close to 4 coherence lengths. Our results provide guidance for pinning optimization in practical superconductors.

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