

Abstract Submitted
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Super-Hard Superconductivity PHILIP ADAMS, DAVID YOUNG,
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Carolina — We present the magnetic response of Type-II superconductivity in the
extreme pinning limit, where screening currents within an order of magnitude of the
Ginzburg-Landau depairing critical current density develop upon the application
of a magnetic field. We show that this “super-hard” limit is well approximated in
highly disordered, cold drawn, Nb wire whose magnetization response is character-
ized by a cascade of Meissner-like phases, each terminated by a catastrophic collapse
of the magnetization. Direct magneto-optic measurements of the flux penetration
depth in the virgin magnetization branch are in excellent agreement with the expo-
nential model in which $J_c(B) = J_{co} \exp(-B/B_o)$, where $J_{co} \sim 5 \times 10^6$ A/cm² for Nb.
The implications for the fundamental limiting hardness of a superconductor will be
discussed.

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