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Destructive regime and step features in ultrathin doubly-connected superconducting Al cylinders H. WANG, Department of Physics, The Pennsylvania State University, University Park PA 16802, N. A. KURZ, M. M. ROSARIO, B. ROCK, M. TIAN, P. T. CARRIGAN, Y. LIU — In doubly-connected superconductors, because of the fluxoid quantization, the supercurrent velocity, v_s, is modulated by the applied magnetic flux. The maximal v_s is inversely proportional to the sample size, leading to a destructive regime in which superconductivity is lost around half-integer flux quanta even at the zero temperature limit, as the sample diameter, d, becomes less than the zero-temperature superconducting coherence length, $\xi(0)$. Our recent measurement shows that for ultrathin Al cylinders with $d < \xi(0)$, regular steps emerge in the resistance vs. temperature $R(T)$ curve as the destructive regime is approached. These resistance steps correspond to minima in dR/dT and are approximately equally spaced in logarithmic scale. These features are not present for large cylinders. We also examined the effect of the size of the measurement currents and found that some steps disappeared at higher measurement currents. All these suggest that the regular step features observed in ultrathin cylinders are not due to the formation of phase slip centers. We will discuss the physical origin of these steps.

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