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Creating nanostructured superconductors on demand by local current annealing HONGWOO BAEK, Center for Nanoscale Science and Technology/NIST, Dept. of Phys. and Astro./SNU, JEONGHOON HA, DUMING ZHANG, BHARATH NATARAJAN, Center for Nanoscale Science and Technology/NIST, Maryland NanoCenter/UMCP, RONGWEI HU, KEFENG WANG, STEVEN ZIEMAK, JOHNPIERRE PAGLIONE, Dept. of Phys./UMCP, YOUNG KUK, Dept. of Phys. and Astro./SNU, JONATHAN P. WINTERSTEIN, RENU SHARMA, NIKOLAI B. ZHITENEV, JOSEPH A. STROSCIO, Center for Nanoscale Science and Technology/NIST — When the effective size of a superconductor becomes comparable to the characteristic length scales, dramatic changes can occur in the superconducting properties that allow various applications in quantum devices. However, challenges remain in controlling the shape and size of specific superconducting materials. Here, we report on a method to create nanostructured superconductors by partial crystallization of the half-Heusler material, YPtBi using scanning tunneling microscopy. Superconducting islands, with diameters in the range of 100 nm, were reproducibly created by local current annealing of disordered YPtBi in the tunneling junction. Tunneling spectra measured on the islands showed non-Bardeen-Cooper-Schreffer behavior with different energy gaps and critical values as a function of spatial position. With increasing magnetic field, conductance maps showed the sequential addition of single vortices in the nanostructure, which fused into a giant vortex ring at 1.25 T. These results demonstrate an interesting method of creating tailored superconductors with complex materials for future applications [1]. [1] H. Baek et al., Phys. Rev. B 92, 094510 (2015).

Hongwoo Baek
Natl High Magnetic Field Lab

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