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Superconductivity of nano-size Pb Islands studied by low-temperature scanning tunneling microscopy / spectroscopy TAKAHIRO NISHIO, TOSHU AN, ATSUSHI NOMURA, KOUSUKE MIYACHI, TOYOAKI EGUCHI, YUKIO HASEGAWA, Inst. Solid State Phys., Univ. Tokyo, HIDEAKI SAKATA, Tokyo Univ. of Science — Nano-size superconducting materials, whose dimensions are comparable with or smaller than their coherent length / penetration depth, behave differently from bulk superconductors. By forming structures using lithographic methods various unique properties of mesoscopic superconductors have been elucidated. Since these studies, however, measure electrical conductance and / or magnetization, details inside the superconductors cannot be directly probed. In this study we investigated superconductivity inside superconductors by directly measuring the superconducting gaps over ultra thin Pb island structures using a LT-STM at 2.0 K [1]. The obtained tunneling spectra exhibit an increment of zero bias conductance (ZBC) with a magnetic field and its dependence on the lateral size of the islands. Moreover, from spatial mappings of ZBC, the island size dependence and spatial variation of superconductivity inside of each island are visualized. We found that the number of vortices piercing the islands before breakdown of superconductivity depends on the lateral size of the islands. Details of the size-dependent critical fields are discussed at the presentation. [1] Nishio et al., APL 88, 113115 '06, JJAP 46, L880 '07.

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