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Proximity-induced superconductivity in the topological surface state of thin Bi_2Se_3 films on Nb probed by ARPES D. FLOETOTTO, Dep. Physics, Univ. Illinois, Y. OTA, ISSP, Univ. Tokyo, Y. BAI, C. ZHANG, Dep. Physics, Univ. Illinois, K. OKAZAKI, A. TSUDUKI, T. HASHIMOTO, ISSP, Univ. Tokyo, S. WATANABE, Tokyo Univ. Sci., C.-T. CHEN, Chinese Academy of Science, J. N. ECKSTEIN, Dep. Physics, Univ. Illinois, S. SHIN, ISSP, Univ. Tokyo, T.-C. CHIANG, Dep. Physics, Univ. Illinois — Topological superconductors (TSCs) are of great interest, since these systems could support novel electronic states such as Majorana fermions. A promising approach to realize TSCs is the preparation of artificial heterostructures involving a superconductor (SC) and a topological insulator (TI) in which the superconductivity is induced into the spin- and momentum-locked topological surface state by proximity coupling. By using angle-resolved photoemission spectroscopy, we have mapped the electronic band structure and determined the proximity-induced superconducting gaps for the simple case of prototypical TI Bi_2Se_3 on elemental s-wave SC Nb as functions of temperature and the thickness of single crystalline Bi_2Se_3 films. For both the bulk and the topological surface states coherence peaks and leading edge shifts of similar magnitude emerge at the Fermi level in the thickness rage of 4-10 QL. The study is an important step towards a comprehensive understanding of helical Cooper pairing in Dirac surface states and the optimization of artificial topological superconductors. Our smart, cleavage-based sample preparation technique is also applicable to other TI/SC heterostructures.

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