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Evolution of the carrier dynamics with quantum transport properties for topological insulator Bi2Se3 as a function of annealing temperature HANBUM PARK, JIMIN CHAE, KWANGSIK JEONG, MANN-HO CHO[1], Yonsei Univ — Topological insulator (TI) has conducting surface state with Dirac fermions. Although the novel properties of surface are robust against perturbations, direct observation of the surface carrier dynamics is usually hindered by unintentional doping from bulk defects. Therefore, it is a critical issue in TI research field to distinguish the surface effects from bulk. In this work, we systematically investigated relationship between the surface and bulk states of Bi2Se3 thin films with post-annealing temperature for crystallization of initially grown as [BixSey]n multilayer. As raise the temperature, Bi2Se3 film, a typical TI material, is formed through self-ordering and has n-type states due to Se defects. In this process, we discovered an evolution of band structure including Dirac cone and upward shift of Fermi level from the photoemission studies. We distinguished contribution of the surface and bulk carriers to electrical properties, and investigated the surface-bulk interaction induced quantum transport by magneto-temperature-resistance measurements. In conclusion, crystallization-induced structural modification and increment in an amount of defects lead to enhance the surface-bulk coherent coupling and suppress the intrinsic transport of topological surface.

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