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STM studies of topological phase transition in $(Bi,In)_2Se_3$[1] WENHAN ZHANG, XUEYUN WANG, SANG-WOOK CHEONG, WEIDA WU, Rutgers Univ, WEIDA WU TEAM, SANG-WOOK CHEONG COLLABORATION —
Topological insulators (TI) are a class of materials with insulating bulk and metallic surface state, which is the result of band inversion induced by strong spin-orbit coupling (SOC). The transition from topological phase to non-topological phase is of great significance. In theory, topological phase transition is realized by tuning SOC strength. It is characterized by the process of gap closing and reopening. Experimentally it was observed in two systems: $TlBi(S_{1-x}Se_x)_2$ and $(Bi_{1-x}In_x)_2Se_3$ where the transition is realized by varying isovalent elements doping concentration. However, none of the previous studies addressed the impact of disorder, which is inevitable in doped systems. Here, we present a systematic scanning tunneling microscopy/spectroscopy study on $(Bi_{1-x}In_x)_2Se_3$ single crystals with different In concentrations across the transition. Our results reveal an electronic inhomogeneity due to the random distribution of In defects which locally suppress the topological surface states. Our study provides a new angle of understanding the topological transition in the presence of strong disorders.

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