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In Situ Characterization Tools for Quantum Materials

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In situ characterization of quantum materials, in particular topological insulator nanomaterials using several, and complementary surface analysis techniques enables to investigate topological surface states without exposing the samples to ambient conditions. Adsorbants from exposure to air and other ex situ contaminations result in notable changes in the bulk and surface state properties of topological insulators. Here, I will describe our recent developments in the in situ characterization of topological insulator nanomaterials.
Spectroscopy techniques are some of the prominent synchrotron radiation based characterization tools, in particular, the X-ray photoemission spectroscopy (XPS) and angle resolved photoemission spectroscopy (ARPES). These techniques allow detailed study of the band structure and determination of elemental composition, chemical state and physical properties of different materials. I will show one of our electronic structure measurements on strontium ruthenate materials performed at Soleil synchrotron facility using ARPES.
Next, I will discuss our XPS and ARPES data on intrinsic Bi2Te3 topological insulator thin films. Extensive studies on individual samples are made possible by connecting the deposition chamber to a large number of surface analysis tools and by using a vacuum suitcase technology that allows samples transfer in ultra-high vacuum conditions for further in-situ analysis at different locations like synchrotron radiation facilities.

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