Proximity-induced superconductivity in a Weak Topological Insulator

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Topological superconductors provide a promising platform to realize exotic phases such as Majorana fermions, which are predicted to assist in achieving fault-tolerant quantum computing. However, intrinsic topological superconductors are extremely rare and thus provide an experimental challenge to move forward. Alternately, such phases can be realized at the interface of a topological insulator (TI) and s-wave superconductor. TIs can be further classified into strong and weak TIs. Recently, we have established that BiSe is a weak topological insulator. Weak topological insulators are elusive topological materials that were subjected to relatively few experimental studies due to the lack of stable systems. Here, we study the proximity effects at the interface of the weak topological insulator Bismuth telluride (BiSe) and s-wave superconductor Niobium diselenide (NbSe 2) fabricated via van der Waal epitaxy. The zero-field differential conductance (dI/dV) spectra at low temperatures manifest a dual-gap feature, suggesting the presence of interfacial superconductivity. Its detailed temperature and field dependence clearly show that the dual-gap feature originates from superconductivity. These superconducting order parameters are then analyzed using the 3-D Blonder-Tinkham-Klapwijk (BTK) model, revealing the presence of unconventional superconductivity at the interface. These superconducting features also appear in magnetoresistance measurements and resistance vs. temperature data. Therefore, this study motivates further exploration of such interfaces in the search for topological superconductivity.