

Conventional s -wave superconductivity in disordered quasicrystalline $\text{Ta}_{1.6}\text{Te}$

T. Machida¹, Y. Guan², T. Hanaguri¹, Y. Tokumoto³, K. Kasai³, A. Fukuda³, S. Sakai⁴, K. Edagawa³, F. Komori^{2,3}, and I. Matsuda²

¹RIKEN Center for Emergent Matter Science, Wako, Saitama 351-0198, Japan

²Institute for Solid State Physics, The University of Tokyo, Kashiwa 277-8568, Japan

³Institute of Industrial Science, The University of Tokyo, Tokyo, 153-8505, Japan

⁴Physics Division, Sophia University, Chiyoda-ku, Tokyo 102-8554, Japan

Quasicrystals lack translational symmetry while retaining long-range order, providing an ideal platform for exploring superconductivity in a unique structural and electronic background. Here, we investigate the surface structure, electronic states, and superconductivity of the van der Waals quasicrystal $\text{dd-Ta}_{1.6}\text{Te}$ using ultralow-temperature scanning tunneling microscopy and spectroscopy. The surface structure is characterized by complex square-triangle tiling patterns that exhibit a heterogeneous mixture of quasiperiodic and approximant-like tiling domains [Fig. 1(a)], accompanied by pronounced spatial variations of the local electronic states on a sub-tile length scale [Fig. 1(b)]. In contrast, spectroscopy in the superconducting state reveals a remarkably homogeneous superconducting gap, well described by weak-coupling s -wave superconductivity [Fig. 1(c)]. Our observations indicate that the superconducting state is insensitive to both the underlying tiling structure and the inhomogeneous electronic states, providing important insight into how superconductivity emerges in the structurally and electronically complex environment of quasicrystals.

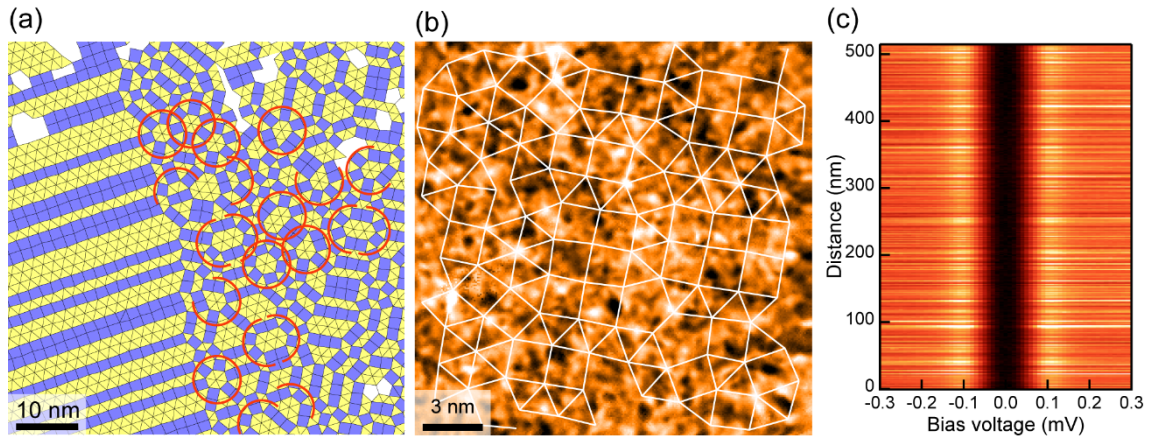


Figure 1: (a) Square-triangle tiling obtained from the topographic image. (b) A normalized conductance map at +10 meV. The white lines represent the tiling structure on this field-of-view. (c) The line profile of the tunneling spectra along a 550 nm-long path that crosses different tiling domains.