Titanium nitride for kinetic-inductance detectors: a problematic material or an engineering opportunity?

Eduard F. C. Driessen[*1]
[1]*Institut de Radioastronomie Millimétrique (IRAM), 38400 St Martin d'Hères, France*
[*]Contact: driessen@iram.fr

Abstract—Titanium nitride and related materials with a large normal-state resistivity have been proposed and used for kinetic inductance detectors at various wavelengths from near-IR to millimeter. The expected advantages of these materials are manifold, e.g. a tunable critical temperature, a large kinetic inductance fraction, and better matching to the incident radiation due to the large resistivity. However, whereas even large (2" diameter) telescope-ready detector arrays have come into sight, the detailed behavior of TiN detectors still shows many puzzling features, at odds with the perfectly understood behavior of "conventional" aluminum KIDs.

In this contribution I will give an overview of the different studies that have been performed on TiN resonators. In this overview, I will emphasize the unconventional behavior of the material, and the differences with aluminum. Among these differences are a smooth detection gap edge, an increasing sensitivity with optical power, and a quality factor that does not change with loading. I will argue that these differences are unavoidably linked to the large normal-state resistivity of the material and its accompanying intrinsic electronic inhomogeneity, and that they should be fully taken into account when considering this material for detectors.

Finally, I will discuss the status of TiN for use in (sub)-mm instruments and I will argue that some of the observed unconventional behavior might in fact prove an engineering opportunity for ground-based observation.