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Optical properties of titanium nitride films under low temperature

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Transition-metal nitrides represent a class of materials receiving growing interest due to their high melting points, providing compatibility to Si platforms, as well as similar optical properties to noble metals such as gold or silver [1]. However, most of quantum photonics platforms operate at low temperatures, meaning that the optical properties of these materials are expected to change.

In this paper, we report the measurement of the reflection spectrum of a 100 nm thick film of titanium nitride (TiN), submitted to cryogenic temperatures. By fitting the data to the Drude-Lorentz model and using the transfer matrix method [2] we were able to retrieve its permittivity, as depicted in Fig. 1. From the permittivity curves we also extracted other properties, such as the quality factor of localized surface plasmons and surface plasmons polaritons [3]. We hope that these results will facilitate the design of metamaterials and other devices aiming integration of TiN with quantum devices.

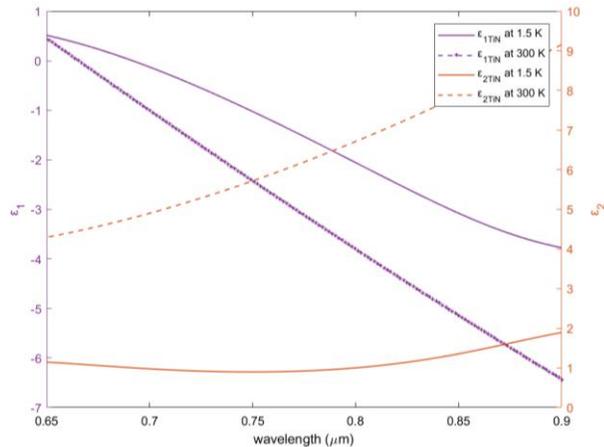


Fig.1: Real (ϵ_1) and imaginary (ϵ_2) parts of the permittivity of TiN, calculated at room and cryogenic temperatures (300 K and 1.5 K), as a function of the wavelength.

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