Optical Properties of Superconducting $Nd_{0.8}Sr_{0.2}NiO_2$ Nickelate

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The intensive search for alternative non-cuprate high-transition-temperature (T_c) superconductor has taken a positive turn recently with the discovery of superconductivity in Nickelates by Li et al. [1]. Indeed, this discovery is expected to be the basis for disentangling the puzzle behind the physics of high T_c in oxides. In the unsolved quest for the physical conditions necessary for inducing superconductivity, we report an optical study of a $Nd_{0.8}Sr_{0.2}NiO_2$ film measured using synchrotron THz and IR/VIS/UV absolute reflectance spectroscopy, at temperatures above and below the critical $T_c \sim 13$ K [2]. In the normal state, the film is described by the Drude model for metallic transport, from which the scattering time just above T_c is determined. The observed Mid-IR absorption indicates the presence of strong electronic correlation effect in the NiO_2 plane similarly to cuprates. Below T_c, the formation of a superconducting energy gap (2Δ) at ~ 3.2 meV is extracted using a fitting algorithm based on the Mattis-Bardeen model. These results together with an estimation of the scattering time are consistent with the superconductive film being in the dirty limit. Finally, a zero-temperature value of 490 nm is extracted for the London penetration depth, which is in accordance with the type-II superconductive nature.

[1] Li *et al*. Nature **572**, 624–627 (2019)
[2] https://arxiv.org/abs/2203.16986