PHOTODETECTION ON AN EXFOLIATED, 2D HIGH-TEMPERATURE SUPERCONDUCTOR

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2D superconductors combine the sharp superconducting properties from the bulk with ultralow heat capacity thanks to their atomic thickness [1]. In particular, 2D high-temperature superconductors are a promising platform for on-chip quantum photonics at moderate cryogenic temperatures (4 K < T < 77 K) [2]. In this work, we report ultrasensitive photodetection at telecom wavelengths using exfoliated flakes of 2D high-temperature superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$ (Bi2212). We use inert-atmosphere van der Waals fabrication techniques and novel non-destructive patterning methods to harness the properties of Bi2212 in the 2D limit. Our photodetectors exhibit record sensitivity at 1550 nm for moderate cryogenic temperatures [2]. Moreover, we demonstrate on-chip integration of our photodetectors on silicon waveguides. This result realizes the promise of 2D high-temperature superconductors as next-generation photodetectors for quantum technologies [3].

References

[1] Saito, Y. *et* al, Nat. Rev. Mat. **2**, (2016) 1-18
[2] Seifert, P. *et al*, 2D Materials **8**, (2021), 035053
[3] Santavicca, D. F., Supercond. Sci. Technol. **31**, (2018), 040502

Figures

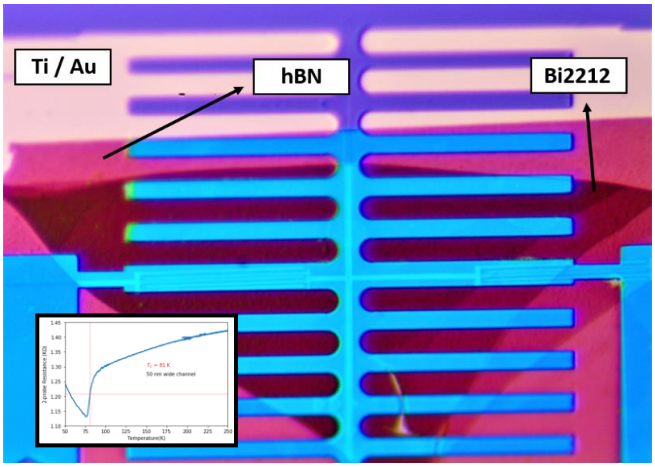

Figure 1: Nano-patterned van der Waals heterostructure for photodetection at moderate cryogenic temperatures.
Inset: Superconducting transition for a 50 nm wide nanochannel.