## Air Sensitivity Analysis of 2D Superconductor Materials for Advanced Josephson Junctions

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2D materials are of increasing interest due to their unique properties, especially in those related to superconductivity. Josephson Junctions (JJs) are traditionally made with Al/Al<sub>2</sub>O<sub>3</sub>/Al, [1,2] however, the low cryogenic temperatures of these devices hinder scalability. Alternative materials need to be identified that will allow these JJs to operate at higher temperatures, this is where 2D materials have great potential.[3]

This study looks at the air sensitivity of two known superconducting 2D materials, NbSe<sub>2</sub> and FeSe. It studies their exposure to air in the controlled environment of a cleanroom over a set period of time and documents the topological changes observed. This helps determine the materials stability to better understand how suited it is to the multi-step process involved in fabricating a JJ. Figures



Figure 1: SEM and EDX spectra of a 5-week-old exfoliated NbSe<sub>2</sub> flake.



**Figure 2:** SEM and EDX elemental mapping of a 5-week-old exfoliated FeSe flake.

## References

- [1] Shim, YP., Tahan, C., Nat Commun, 5, (2014)
- [2] Zheng, Y., Li, S., Ding, Z, Sci Rep, 13 (2023)
- [3] Lemme, M.C., Akinwande, D.,Huyghebaert, C. et al., Nat Commun, 13 (2022)