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Controlled fabrication of Nb-based dayem bridge Josephson Junctions for highly- replicable SQUIDs

Superconducting quantum interference devices (SQUIDs) combine the physical phenomena of flux quantization and Josephson tunneling, resulting in a device that is extremely sensitive to magnetic field fluctuations. Due to their quantum behavior, SQUIDs are fundamental elements in the development of new quantum technologies in the field of sensing and computing.
They have the ability to perform broad frequency bandwidth ultrasensitive magnetic flux measurements at low temperatures. Therefore, they are commonly found in instruments such as amplifiers, magnetometers or gradiometers used in quantum sensing applications 1. They area also suitable as tunable couplers, controlling the coupling between several elements, such as qubit-qubit interactions or qubit-quantum bus interactions thanks to their variable inductance characteristic [2].
To achieve high reproducible devices, a tight control over the fabrication process of the Josephson Junctions (JJ) -as the main constituents of SQUIDs- is required. To that end, we propose the fabrication of Nb-based nanobridge Josephson Junctions. The target area is protected by a Pt layer grown by focused-electron-beam-induced-deposition (FEBID) and Focused Ion Beam (FIB). Higher control is achieved in the fabrication process attaining a better reproducibility rate.

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References

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