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M2Po3C-02: Enhancing Flux Expulsion Through Microstructural Control in Superconducting Radiofrequency Cavities Made from Cold-Worked Niobium

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A well-known source of RF losses that lower the performance of superconducting radio frequency cavities is due to the residual magnetic flux trapped during cool-down. In this presentation, we demonstrate how manipulating the niobium microstructure by changing the strain state of the initial Nb sheet for an elliptical cavity geometry, can improve the flux expulsion behavior. In this study we compare the use of traditional annealed poly-crystalline Nb sheet with sheet from the same origin but without the anneal and therefore retaining cold work strain from the sheet rolling process. We find that an 800℃ heat treatment of the formed traditional sheet leads to a bi-modal microstructure that relates to flux trapping and inefficient flux expulsion. This non-uniform microstructure is related to varying strain profiles along the cavity shape. However, a more uniform microstructure after 800 ℃ annealing is achieved when using a cold-worked Nb sheet, resulting in better flux expulsion, without the need to perform the annealing at a higher temperature.

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