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M2Po3C-03: Impact of retained cold work on the microstructure and fabrication of SRF Nb cavities

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High cryogenic efficiency, measured as the quality factor (Q_0, 2K), has been made possible in Nb superconducting radio frequency (SRF) cavities due to advances in understanding the sub-surface micro-chemistry and structure developed in cavity processing. Recent experiments in SRF cavities have demonstrated the role of bulk cavity microstructure and its influence on trapped residual magnetic flux and related expulsion. Importantly, a more homogeneous microstructure can be obtained after heat treatment by initially forming the SRF Nb cavities from Nb sheets that are in the cold-worked state. The improved microstructural uniformity correlates to better flux expulsion and higher overall Q_0. In this work, we explore the influence of different levels of cold work on the development of the microstructure of SRF Nb sheet. We report on the following: (1) the microstructure evolution in cold rolled SRF quality Nb sheets undergoing reductions of 30, 40, 50, 70% and after subsequent heat treatments between 600- 900℃, (2) fabricability of 30, 50, and 70% cold work sheets into Nb cavities, and (3) flux expulsion results on Nb cavities fabricated with the above sheets. Based on these results we discuss the issues that must be addressed to harness the potential of using cold-worked sheets for SRF cavity production.

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