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Results of Q disease tests with 350-MHz spoke cavities

T. Tajima, R. L. Edwards, F. L. Krawczyk, D. L. Schrage and A. H. Shapiro

Abstract

Spoke cavities have been developed at LANL for an accelerator-driven nuclear waste transmutation system. One of the most important issues for this development is how we can build and operate the accelerator at minimum costs. It would save a significant amount of money if we do not need to heat treat the cavity at high temperatures. This motivated us to check to see if Q disease occurs with 350-MHz spoke cavities. We have tested 3 cavities, ANL, LANL/EZ02 and LANL/EZ01 so far. The ANL cavity was made of RRR~150 and the LANL cavities were made of RRR~250 niobium. The ANL cavity was chemically polished 98 microns at LANL with a standard buffered chemical polishing (BCP) solution, i.e., $HF:HNO_3:H_3PO_4$=1:1:2 by volume, at 14 - 18 ºC. We did not see any Q degradation after holding the cavity at 100 – 102 K for 13 hours or at 100 – 142 K for 86 hours. This cavity was unintentionally baked at ~ 250 ºC, which may have caused thicker oxide layer that prevent the Q disease from occurring as well as due to lower RRR.

The LANL/EZ02 and LANL/EZ01 cavities were polished 150 microns with standard BCP solution at <15 ºC. The LANL/EZ02 showed ~ 50 % Q degradation after holding the cavity at 100 – 132 K for 61 hours. Although the same material was used, LANL/EZ01 has shown much less degradation as compared to LANL/EZ02. A systematic test with LANL/EZ01 to determine the dangerous temperature range precisely is under way by changing the holding temperature every 10 K. The detail of the results will be presented.