

Test Notes on Vertical Test Result of Cavity TE1ACC003 #04

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Current test summary of TE1ACC003

Laser re-melting cavity **TE1ACC003** has been tested for the fourth time after two light EP at ANL ($12\ \mu\text{m} + 20\ \mu\text{m}$). Cavity reached **39.4** MV/m and limited by quench. This test showed the laser re-melting technique is suitable to repair cavity geometric defects such as pit or similar. Quench location remained at laser re-melting location indicated by fast thermometry system.

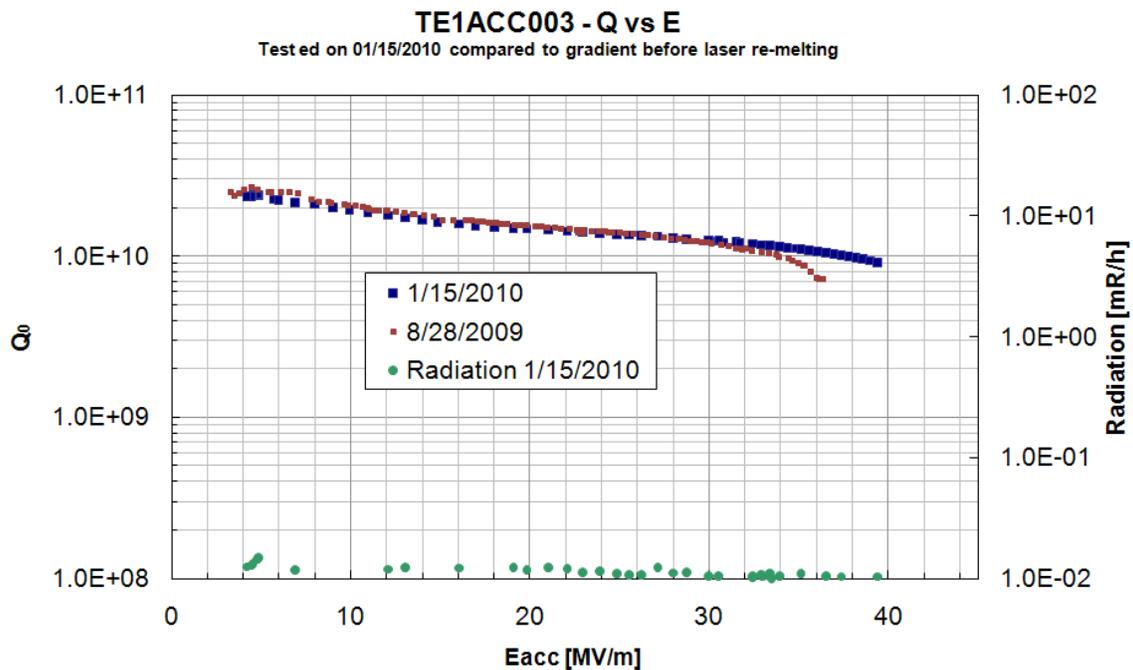


Figure 1: Q and radiation versus Eacc for TE1ACC003 test #4.

During the fourth test on 1/15/2010, cavity was paired to another cavity (TE1ACC004) and cooled down to 2K with no active pumping. CW power measurement was performed without the Q-T measurement. Field probe calibration conducted around 4.5 MV/m yielded $Q_2 \sim 3.17 \times 10^{12}$. The superfish calculated kappa (82.2) for the TESLA shape single cell was adopted. Low field Q_0 obtained was 2.4×10^{10} . The RF power rise was basically a quite smooth ride with no multipacting and no elevated X-ray until cavity quenched at 39.4 MV/m, where the cavity Q stayed at 9.35×10^9 . After several quench events, cavity field degraded to 34.5 MV/m with slightly lower Q. This is believed to be mostly caused by flux trapping. At this moment, fast thermometer was used to identify the quench location.

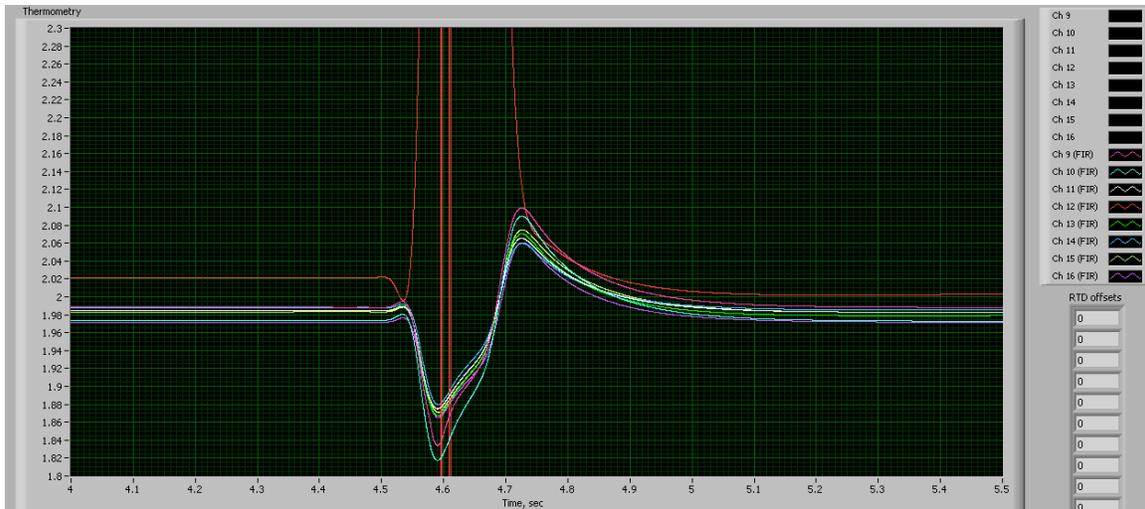


Figure 2: RTD#4 (channel 12) showed the maximum temperature rise for TE1ACC003.

One of the eight thermometers was located right on the laser re-melted pit location (RTD#4). As shown in Figure 2, that laser spot showed the highest temperature during the quench event. The T-map data will be further analyzed and reported elsewhere.

Previous RF tests of TE1ACC003

After the cavity was received from ACCEL, it was inspected using camera inspection system developed by KEK and Kyoto University. Several pit features were observed. Cavity was electropolished at ANL with a bulk material removal of 119 μm . Once the cavity was initially cleaned with ultrasonic soap and high pressure water rinsing, the cavity was inspected again by camera inspection system. Several pit feature were polished away with 8 remained.

(<http://tdserver1.fnal.gov/genfa/single/images/TE1ACC003/index.html>)

First test was done on 4/10/2009. Performance was at 42.1 MV/m limited by quench. The above background x-ray was negligible.

(<http://tdserver1.fnal.gov/genfa/single/TeslaSingle/TE1ACC003/TE1ACC003TestNote.pdf>)

In September 2009, new cavity geometric number was used to reflect the real cavity shape. Kappa in the test program was reduced from 93.1 to 82.2. This would reduce the previous gradient 42.1 MV/m down to 39.9 MV/m.

Second test was conducted on 8/28/2009 after the cavity was applied molding material. It reached quench limiting 36.3 MV/m.

(http://tdserver1.fnal.gov/genfa/single/TeslaSingle/TE1ACC003/TE1ACC003_2_testnote.pdf)

Laser re-melting was conducted on 11/13/2009 purged with Argon.

The cavity received light EP at ANL with material removal of 12 micron. The acid was suspected not well mixed resulting abnormal I-V curve throughout the EP process.

Third test was conducted on 12/1/2009. It reached 26.1 MV/m and limited by quench at location other than the laser re-melted spot.
(<http://tdserver1.fnal.gov/genfa/single/TeslaSingle/TE1ACC003/TE1ACC003TestNote-3-1.pdf>)

The optical inspection indicated the quench location corresponds to different geometric feature, which did not cause quench in all previous tests.

The cavity received another light EP at ANL with material removal of 20 micron. This latest EP showed normal I-V characteristics. Low temperature baking was conducted at A0 facility afterwards.

Figure 3 showed all previous RF test results.

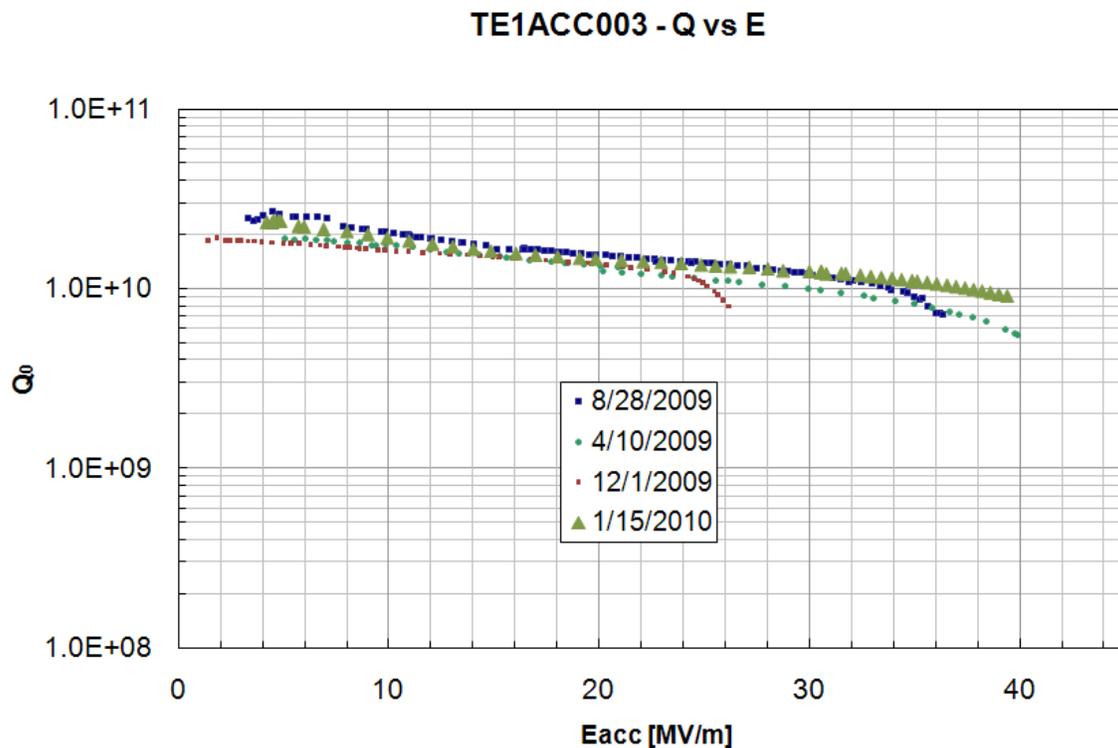


Figure 3: Q versus Eacc for TE1ACC003 RF tests.