Test Notes on Vertical Test Result of Cavity TE1ACC003 #02

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Current test summary of TE1ACC003

Cavity TE1ACC003 has been tested for the second time after molding was done to extract the pits geometry. Cavity reached 36.3 MV/m and limited by quench. This test further verified the replica technique is compatible with high gradient cavities. Quench location was verified using fast thermometry system.

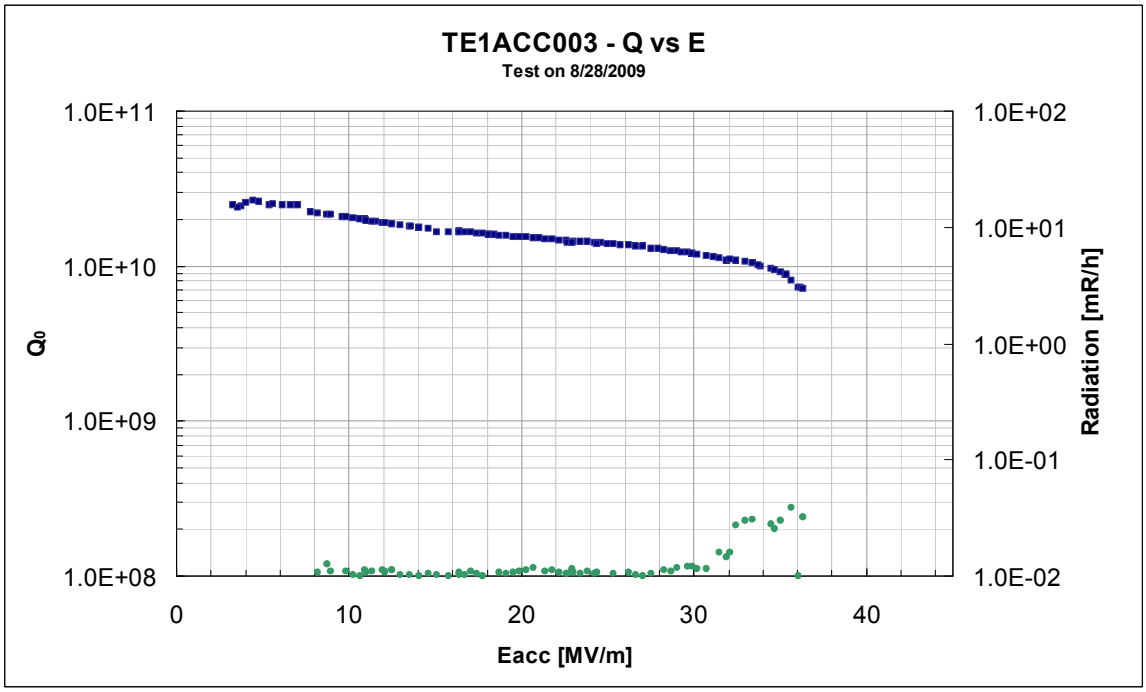

Figure 1: Q and radiation versus Eacc for TE1ACC003 test #2.

During the second test on 8/28/2009, cavity was paired to another cavity (NR-1) 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 ~ 2.85e12. The superfish calculated kappa (82.2) for the TESLA shape single cell was adopted. Previous kappa used was 93.1 [1]. Low field Q_0 obtained was 2.67×10^{10}. Approaching 32 MV/m, X-ray detector started to pickup some above background signals. The test progressed without multipacting until 36.3 MV/m when quench became dominant at Q_0 = 7.14e9. The X-ray radiation remained near background as shown in Figure 1.

TE1ACC003 has 8 visible pits scattered near equator, most of them were out of typical heat affected zone. Figure 2 shows the largest pit with its geometric profile obtained through replica technique.

Before the RF test, Fast thermometers were attached near the pit as shown in Figure 3.

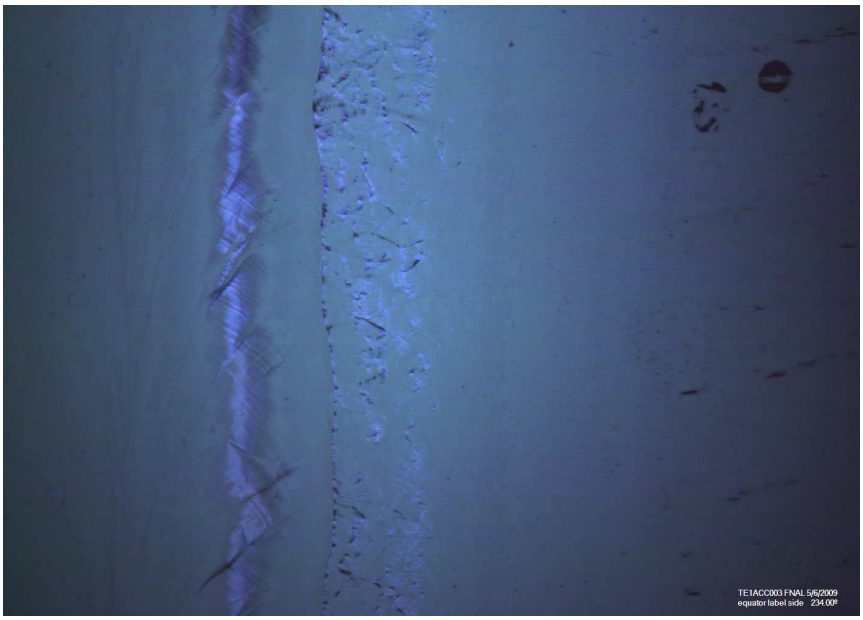

Figure 2: The largest pit in cavity TE1ACC003

Figure 3: Thermometers attached right below the pit in TE1ACC003.
The thermometer data showed the quench was close to the pit location.

Compared to the previous test as shown in Figure 4, the performance was slightly lower, yet well within the RF measurement error of Q and Eacc. The relative accuracies of Eacc for these two tests were 10% and 8% respectively.

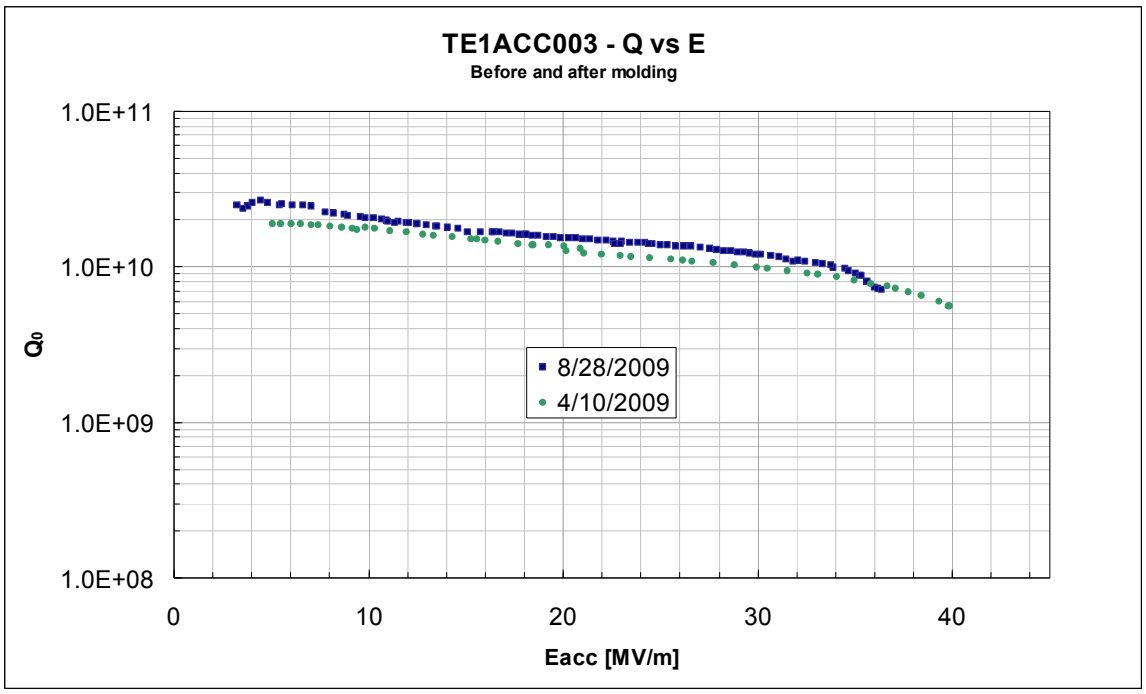

Figure 4: Overall Q versus Eacc for TE1ACC003 tests.

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)

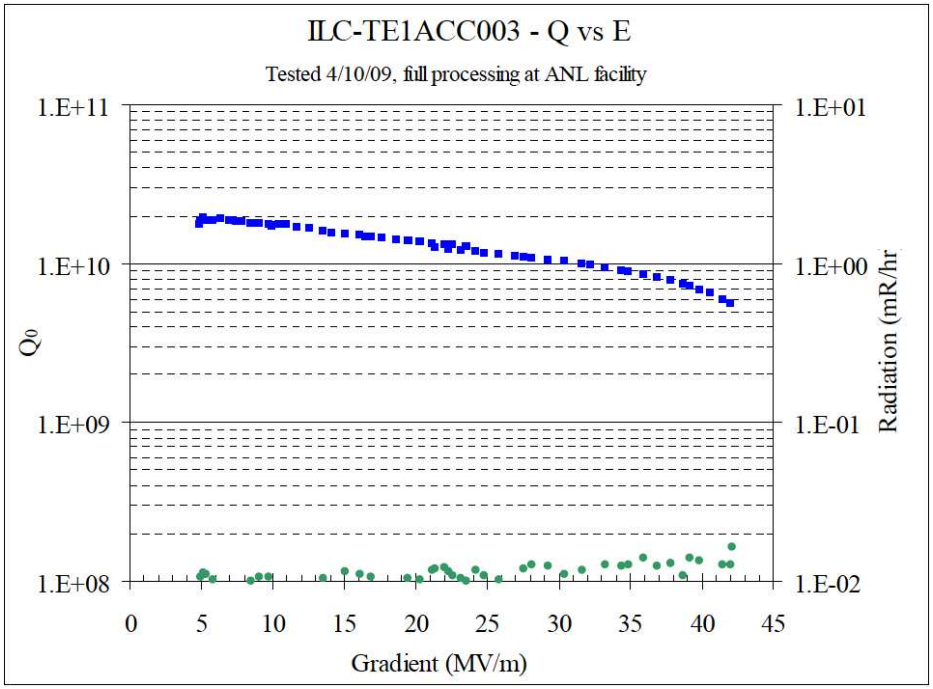

Figure 5: Q and radiation versus Eacc for TE1ACC003 test #1.

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