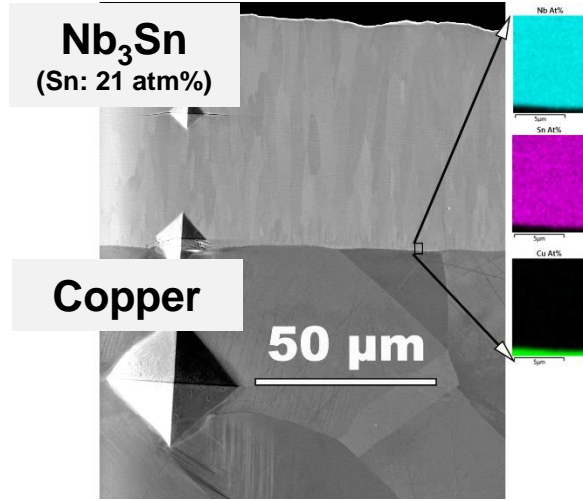


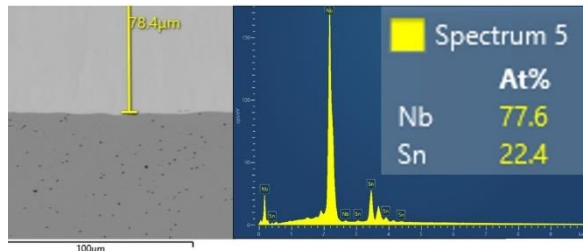
PROGRESS



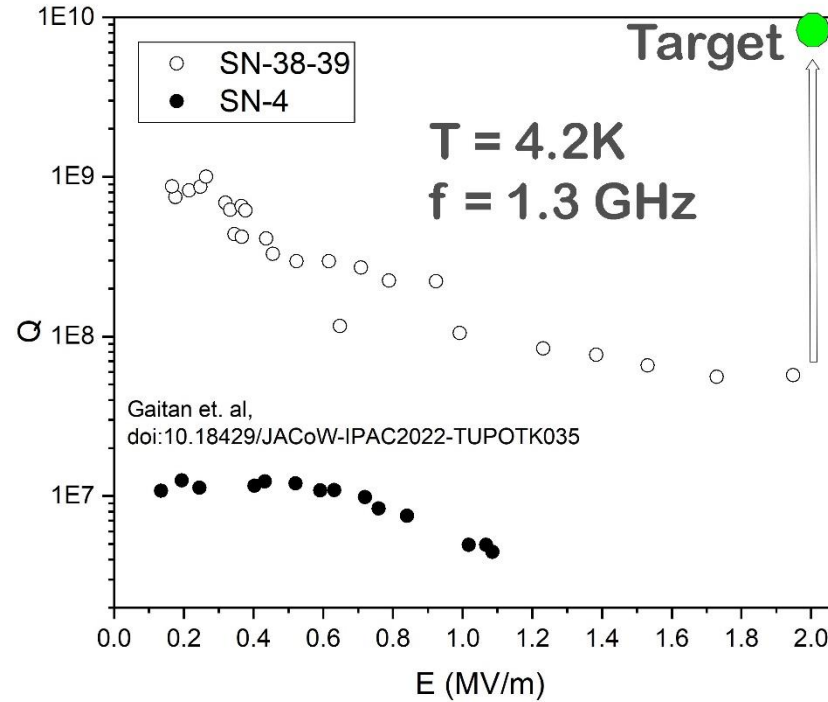
CVD Nb₃Sn coating on CVD niobium interlayer on welded (Niowave) copper cavity substrate



CVD Nb₃Sn coating on copper substrate: excellent adhesion



CVD Nb₃Sn on welded copper cavity

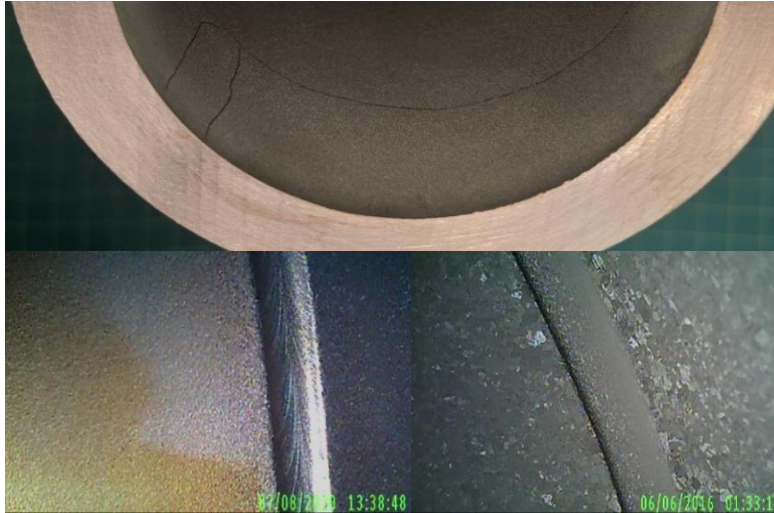


Q vs. E for first-of-kind CVD Nb₃Sn welded copper cavity SN38-39 and seamless copper cavity SN-4 with CVD Nb₃Sn coating on CVD niobium interlayer at 4.2 K



SN-4A, seamless copper cavity substrate (BTM, Inc.)

CHALLENGES



SN38-39: ring-crack in Nb₃Sn coating on one tube (*top*); equator pre-coating (*bottom left*) and as-coated and as-tested (*bottom right*)



Left, SN-2, as-received surface roughness and anomalies; *right*, SN-4, post-etch copper and as-coated & as-tested.

What Is Needed for CVD-based Nb₃Sn/Cu Cavities

Non-Trivial Factors Impeding CVD-based Cavity Technology Growth

- ❖ **Cavity Design** Define cavity design early to enable focused, efficient, relevant process R&D for all involved
- ❖ **CVD Nb₃Sn-on-Copper Process Development & Scaling**
 - CVD reactor customization and optimization
 - CTE mismatch, thermostructural analysis, and interlayers
 - ID surface conditioning methods for bare copper and Nb₃Sn coatings
 - OD strengthening methods: AM, electrochemical, thermal spray?
- ❖ **Precursor Process Development & Scaling**
 - **Fundamental R&D:** Precursor process development leading to reliable supplier for high-quality precursors
- ❖ **Copper Cavities** Expanded domestic infrastructure & capabilities
 - **Fundamental R&D** Copper cavity substrate process R&D for high-quality cavity substrates necessary for efficient, relevant R&D leading to reliable supplier(s) (with inventory!)
- ❖ **Testing** Ready access to material and cavity testing
 - Ideas? Quick-check/in-process cavity test methods?
- ❖ **CVD Nb₃Sn-on-Copper Cavity Production**
 - Build-test-repeat to TRL-9