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Frequency-tunable SRF cavities for microwave opto-mechanics ALESSANDRO CASTELLI, LUIS MARTINEZ, JACOB PATE, JOHNATHON THOMPSON, RAYMOND CHIAO, JAY SHARPING, Univ of California - Merced — Three dimensional SRF (Superconducting Radio Frequency) cavities are known for achieving high quality factors (Q=10^9 or higher) but suffer from limited frequency tunability once fabricated and cooled to superconducting temperatures. Our end-wall design allows for numerous applications of cavity tuning at temperatures as low as 40 millikelvin. Using a bimorphic piezoelectric transducer, we demonstrate approximately 15 MHz of resonance tunability for the TE011 mode at cryogenic temperatures in a cylindrical reactor grade niobium (Nb) cavity (10% of the range at room temperature). This range doubles when using tunable end-walls on both cavity ends. We report on techniques for improving the Q of multi-component cavities including the use of concave end-walls to reduce fields near the cylinder ends and indium O-rings to reduce resistive losses at the gaps. Three-dimensional SRF cavities of this type have potential applications to quantum information science, precision displacement metrology, and quantum electro-dynamics.

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