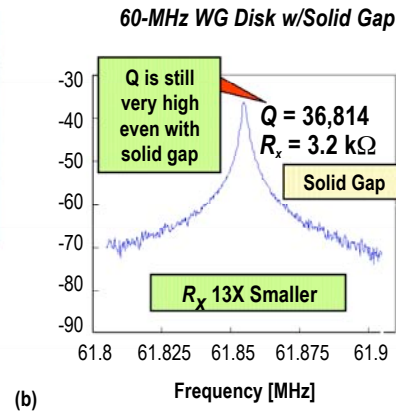
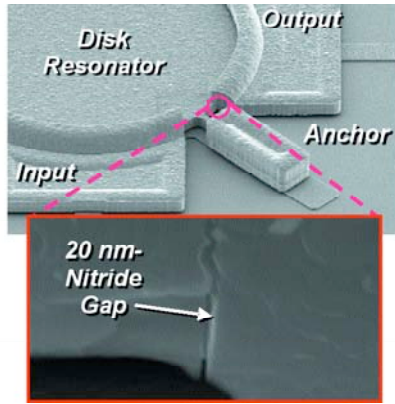


Vibrating Micromechanical Resonators with Solid-Dielectric Capacitive Transducer Gaps

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VHF and UHF MEMS-based vibrating micromechanical resonators with new solid-dielectric-filled capacitive transducer gaps to replace previously-used air gaps have been demonstrated at 160MHz, with Q 's $\sim 20,200$ (on par with air-gap resonators) and motional resistances (R_x 's) more than 8X smaller at similar frequencies and bias conditions. This degree of motional resistance reduction comes



about via not only the higher dielectric constant provided by a solid-filled electrode-to-resonator gap, but also by the ability to achieve smaller solid gaps than air gaps. These advantages with the right dielectric material may now allow capacitively transduced micromechanical resonators to match the 50–377 Ω impedances expected by off-chip components (e.g., antennas) in many wireless applications without the need for high voltages. In addition, to lower motional resistance, the use of filled-dielectric transducer gaps (a) better stabilizes the resonator structure against shock and microphonics; (b) eliminates the possibility of particles getting into an electrode-to-resonator air gap (c) greatly improves fabrication yield by

eliminating the difficult sacrificial release step needed for air gap devices; and (d) potentially allows larger micromechanical circuits by stabilizing constituent resonators as the circuits they comprise grow in complexity. These benefits, together with the novelty of the technique, earned this work the Best Student Paper Award in the Frequency Control Category at the 2005 IEEE International Frequency Control Symposium.