3C-SiC resonators: fabrication, modelling and characterization

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The cubic silicon carbide (3C-SiC) layers on silicon(or silicon-based) substrates are considered interesting materials for sensors and micro- and nano-electromechanical systems (MEMS and NEMS), due to its exceptional physical and chemical properties [1]. Furthermore, the high Young's modulus and the relatively low mass density induce a significantly higher resonant frequencies and quality factors in resonant devices at the same geometrical dimensions in comparison with Si or gallium nitride [2-3]. In this paper the stress field distribution in 3C-SiC (111) resonators with a double clamped beams structure was studied by COMSOL simulations. The measurements showed that the asymmetry of the anchor points configuration produce an asymmetry in the stress filed distribution. This behavior was confirmed also by micro-Raman measurements. Furthermore, from the simulations the importance of the reduction of the under etching of the anchor points of the resonators was observed. In particular, the reduction of the region of under etch produces a decrease of the stress in the double clamped beams, a small reduction of the resonance frequency, and a large reduction of the Q-factor.

References

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