BEAM SHAPED RESONATOR MADE FROM EBL AND RIE TECHNIQUES

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Nowadays, the transfer of information via telecommunication channels is part of our routinary way of live. For this reason, the systems that play a role in this feature are object of multiple kinds of investigations and produce an important amount of publications.

The use of resonant electromechanical devices as a component of RF systems (RF-MEMS, i.e. filters, switches and voltage-controlled oscillators, etc…), constitutes an emerging field into these investigations. One of the main issues in this kind of devices is the quality factor of the mechanical resonator. Researchers have explored different structures in order to achieve high quality factors and adequate coupling parameters. Structures like beams, squares and circles are extendedly studied.

In our work, we propose a bulk acoustic mode resonant beam [ref2] at 10 MHz. First, mechanical calculations have been performed by a finite element method based solver COVENTOR [ref1], and then, from these simulations, mechanical parameters as resonance frequency, equivalent effective mass and equivalent spring constant have been extracted.

The beam has been made on SOI, using EBL and RIE techniques, in order to obtain a minimum gap between beam and driver (below 500 nm). For small gaps, a new RIE recipe has been developed, resulting in a very good vertical gap shape, with an aspect ratio around 10.

We have performed an electrical detection of the mechanical resonance of the device by means of a capacitive readout scheme. This readout method is based on measuring the current which is generated by the capacitance variation due to the movement of the resonator, and a voltage between the resonator and the read-out electrode.

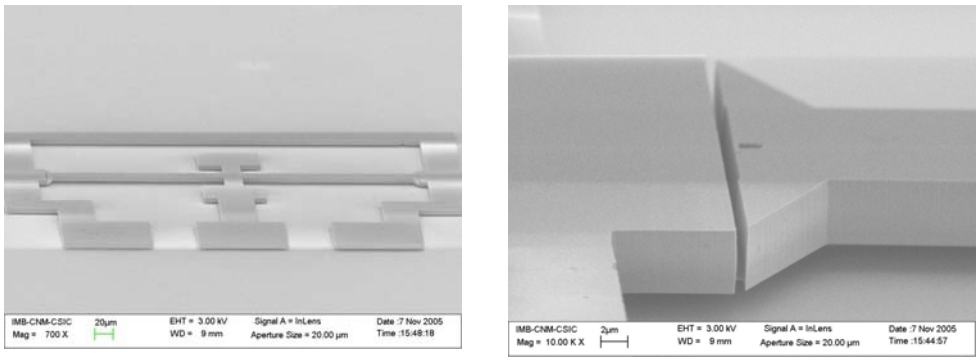

Fig. 1: Two SEM images of the device, the whole system (left) and the coupling gap (right)

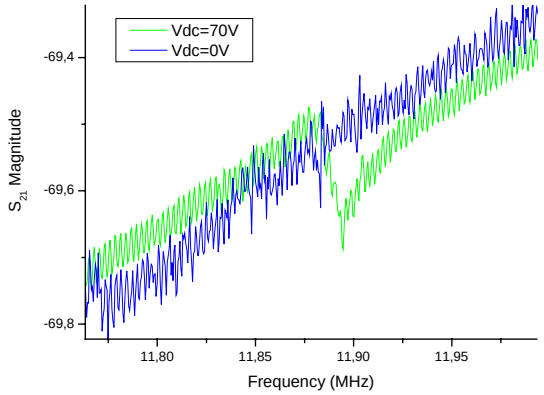

Fig 2. S_{21} magnitude vs frequency for two voltages: 0 V (without resonance) and 70 V (where we can see the device resonance).

Ref1: www.coventor.com
Ref2: Mattila T. et. al, Sensors and Actuators A **101**, 2002, pp. 1-9