Activities of Laboratory of Microsensor Structures and Electronics(LMSE) UL FEE, SLOVENIA

Laboratory of Microsensor Structures and Electronics (LMSE) is involved in research and development of microstructures such as silicon devices, sensors, actuators and microelectromechanical systems (MEMS). Internal properties and external characteristics of these structures are studied using analytical and computer modeling.

Technologies available in LMSE allow investigations of new processes in the fields of mask design and fabrication, photolithography, diffusion, metallization, depositions, cleaning, thin film processing, etching, micromachining etc. Based on these activities, research and development of various new microstructures such as photo sensors, pressure sensors, temperature sensors, radiation sensors, sensors for nuclear physics, actuators, piezoelectric structures, nanostructures, various 3D micromechanical structures, MEMS and similar, is going on. Research is supported by advanced measurement equipment and characterisation techniques, aided by process and device modeling.

Research activities are also involved in the field of electronic circuit theory, advanced circuits, their simulations and applications. Harmonic balance is used as a powerful method of analysis for nonlinear dynamic circuits. The team is also engaged with practical solutions in the field of microprocessor based digital electronics. It encompasses the development of appropriate hardware and software for automatic measurements of electronic and telecommunication equipment. Cooperation with manufacturers of professional electronic equipment is as well established.

LMSE is a free university lab, open for any kind of cooperation with other laboratories and industry. LMSE is collaborating with European universities under the framework of international projects sponsored by the EU commission. LMSE has a well established cooperation with leading institutions in the field all over the world.

LMSE offers complete research and development services in the field of microstructures and electronics, from theoretical analysis to fabrication of test structures, devices and circuits, their characterisation and optimisation.

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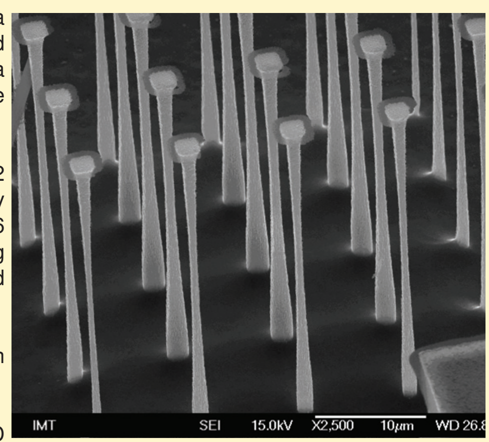
A new RIE technology approach in LMSE

Today, for dry etching of silicon in MEMS/MOEMS applications so called Deep Reactive Ion Etching (DRIE) systems are used which, in regard to standard RIE systems include an additional Inductive Coupled Source (ICP). By this and in a connection with a capacitive coupled radio-frequency RF source, these etch systems enable high etching rates (15 μm/min), high selectivity (up to 200) and perfect control of etching profiles (near vertical profiles with minimal undercuts).

In addition to these approaches, in LMSE we have developed recently a new optimized process of similar anisotropic RIE of silicon on a standard RIE system, Plasmalab P 80 from Oxford Instruments, Plasma Technology, UK that is basically designed for anisotropic and selective etching of thin silicon oxide and nitride layers on silicon substrate.

The developed process works at room temperature using SF_6/O_2 chemistry. By a proper control of process parameters we can successfully control etching parameters. Thus we are achieving etching rate of 1.6 um/min, anisotropy of 0.9, undercut less than 5% relative to the etching depth, 10% uniformity across the wafer, and selectivity to silicon oxide and photoresist of 90 and 20, respectively.

An example of anisotropic RIE etching of silicon pillars array under thin oxide mask is shown in SEM photomicrograph below.



Evaluated etching process enables the realization of various 3D micro/nano structures such as high aspect ratio trenches, sharp micro/nano tips and many other subparts for MEMS and MOEMS.

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The publication of this page is supported by the ***MINOS-EURONET*** project (EC Contract No 015704)