Poster
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HSG IMIT

Monolithic Bridge-on-Diaphragm Transducer with Piezoelectric Excitation Fabricated by Laser Micromachining

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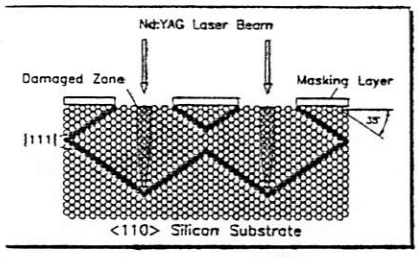
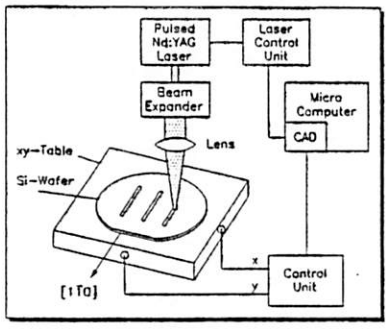
Principle of fabrication

Photolithographic patterning of the masking layer
Local destruction of {111} crystal planes by laser melting
Anisotropic etching



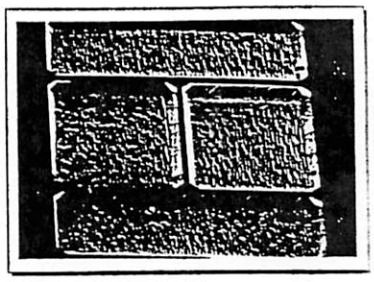
Schematic diagram of a **monolithic microbridge** with triangular cross section and with slope angle of 35° formed **by laser machining and anisotropic etching**

Experimental setup



Schematic diagram of the experimental setup including **a cw pumped Nd:YAG laser system with Q-switch and a computer-controlled xy-table** for precise positioning of the silicon wafer

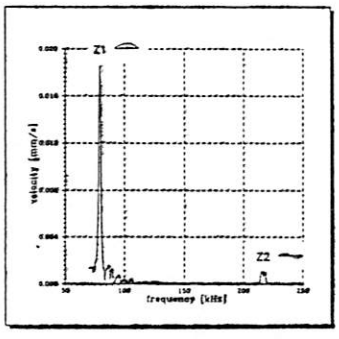
Experimental realization



SEM micrograph of a **monolithic bridge-on-diaphragm** (B structure.

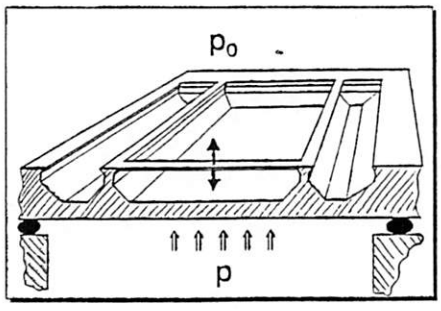
Dimensions: Bridge: 120 μm × 40 μm × 1950 μm
Diaphragm: 5000 μm × 5000 μm × 15(

Frequency spectrum



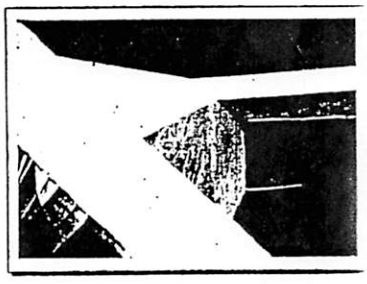
Frequency **spectrum** of the **fundamental flexure modes** Z1 and Z2 obtained by **optical measurements** (laser vibrometer and spectrum analyzer)

BOD-structure as pressure sensor



Change of **resonance frequency** f due to an applied **pressure difference** $p-p_0$

Experimental realization



SEM micrograph showing the clamping region of the microbridge

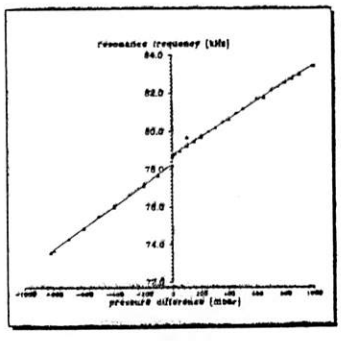
Resonance frequencies

Mode	frequency [kHz] FEM	frequency [kHz] experiment	measured Q-factor
Z1	77.6	77.4	370
Z2	213.6	217.3	1 200
Z3	417.9	426.7	-

Resonance frequencies of the fundamental flexure modes Z1, Z2, Z3 **obtained by Finite Element Analysis (FEM)** in comparison with experimental data.

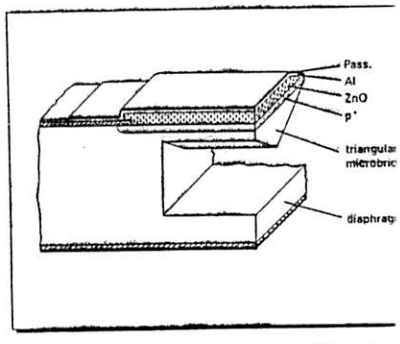
Geometrical data of the microbridge:
length = 1.95 mm
thickness = 38 μm
slope angle = 35°

Pressure sensitivity



Resonance frequency (flexure mode Z1) as a function of pressure difference measured by piezoacoustic excitation and optical detection

Piezoelectric excitation



Excitation and detection of resonant microbridge via piezoelectric thin film (ZnO)