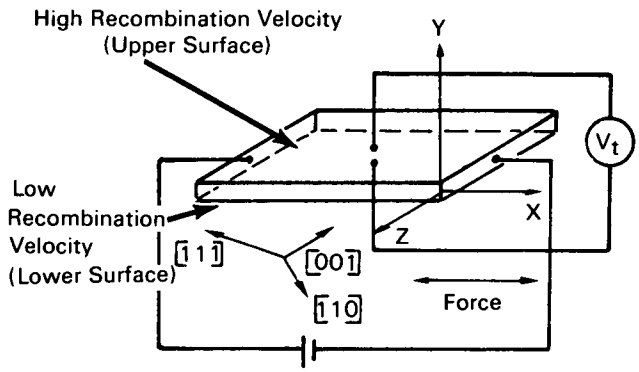
NASA TECH BRIEF

New Transverse Piezoresistance and Pinch Effect Electromechanical Transducers: A Concept



Pinch Effect Transducer

Generation of a transverse voltage in a semiconductor forms the basis for a new electromechanical transducer. This transverse voltage results from the combined effects of piezoresistance and the pinch effect (Note 1) and can be several orders of magnitude larger than from piezoresistance alone, provided the crystallographic orientation is suitably chosen and the semiconductor surface appropriately prepared.

Longitudinal bias and pressure are applied to the device, as shown in the figure. Two transverse contacts measure the potential drop along the y axis resulting from the current flow and stress. Under longitudinal bias the device responds to pressure input with a transverse voltage V_t proportional to the pressure signal. In the absence of a signal, V_t is zero even with bias, and regardless of temperature, if the transverse contacts are appropriately positioned along a zero-pressure equipotential.

This particular device requires at least one boundary with very low recombination velocity. Formation of a junction inhibiting the flow of excess carriers into the surface would in effect yield such a near zero recombination boundary for the bulk.

A low recombination boundary may be formed in the device by varying the physical properties of the bulk material.

Notes:

1. Additional information which describes the physical process of the piezoresistance and pinch effect can be obtained from the Soviet work reported by E. Rashba, V. Romanov, I. Boiko and I. Zhadko; Phys. Stat. Sol. 16,43 (1966).
2. Requests for further information may be directed to:

   Technology Utilization Officer
   Headquarters
   National Aeronautics
   and Space Administration
   Washington, D.C. 20546
   Reference: TSP70-10075

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, nonexclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

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(ERC-10088)

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