Sensors and Materials, 2, 1 (1990) 001–005
MYU, Tokyo

LETTERS

S & M 0032

Micromachining in Bulk GaAs

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(Received October 24, 1989; accepted November 25, 1989)

Key words: gallium arsenide, GaAs, micromachining, micromechanics, wet etching

As a sensor material, GaAs has several advantages over silicon, but also a number of disadvantages which have resulted in a rather limited use of GaAs for transducer applications. Some disadvantages of GaAs have been its comparatively low degree of crystal perfection, processing difficulties and low mechanical strength. This letter demonstrates a scheme of micromachining by which well-defined structures can be fabricated directly in single-crystalline bulk GaAs by conventional lithography and wet etching techniques, hence eliminating the epitaxy process. It is also indicated that properly performed bulk micromachining of GaAs results in microelements of very high mechanical stength, making mechanically active GaAs elements more interesting, e.g., in applications such as highly sensitive capacitive microsensors, microsensors in a high radiation environment, or microsensors using the optoelectrical qualities of GaAs compounds.

1. Introduction

GaAs usually is found in applications where very fast signal processing is required[1] or in devices which utilize the specific optoelectronic properties of the material.[2] In these applications, the micromachinability of GaAs is rarely the limiting factor. However, there are fields of application—or possible application—where the machinability can be of crucial importance. As a sensor or actuator material, GaAs has advantages as well as disadvantages in comparison with silicon. Among the advantages are its nonzero piezoelectric coefficient, its higher Peltier coefficient, its direct band gap facilitating efficient two-way conversion between electrical energy and light, its higher radiation hardness, its lower stiffness, and its wider operative temperature range. Among the disadvantages, we should mention that