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Novel Structures for Miniature Pressure Transducers Obtained by Electrochemical Etch-Stop on Diffused Membranes

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Novel structures are permitted in the design of miniature piezoresistive pressure sensors using electrochemical etch-stop to fabricate vertically structured membranes. These structures address the problem of increasing nonlinearity in highly sensitive pressure sensors featuring small areas for biomedical applications. Mechanical design considerations and manufacturing problems are discussed.

1. Introduction

One of the main problems in the design and fabrication of highly sensitive piezoresistive pressure sensors is the increase of nonlinearity beyond tolerable limits for high-precision devices. Most of the reported designs to prevent this problem are based on a local stiffening of the membrane, using bosses with full wafer thickness, while the resistors are kept in a local stress concentration area.[1-5] When miniaturization is an essential goal, these designs are inefficient because of the lateral size ({111} walls) of the rigid bosses. In addition, because these design approaches improve nonlinearity at the expense of sensitivity, it is necessary to optimize the mechanical structure and piezoresistor location on the diaphragm to reduce nonlinearity for a prespecified sensitivity.

This work is focused on the solution of the aforementioned problems using a new technology based on electrochemical etch-stop.[6] It allows fabrication of novel structures,