ANALYTICAL MODELING AND SIMULATION OF THE CHEMICAL ETCHING PROCESS OF THE BORON-DOPED SILICON LAYERS FROM BBr_3 SOURCE IN THE MICROMACHINING TECHNOLOGY

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Abstract: *The boron-doped silicon layers commonly used to fabricate various micro-mechanical elements, particularly silicon membranes, are efficient stop-etching barriers, so their control is crucial in the bulk micromachining technology. As the properties of the boron doped layers depends on the type of the doping source and on the diffusion depth in the silicon bulk, a particular analysis should be applied in each specific case. In this paper there are reported the results of an analytical modeling of the boron diffusion profile in silicon, which are applied to simulate the boron diffusion profile at high diffusion temperatures (1050°C, 1100°C, 1150°C and 1200°C), emphasizing a dependence of the diffusion coefficient as a square root of the boron diffusion concentration. It is shown that the comparison of the theoretical results and some experimental diffusion data after diffusion at 1050°C shows a very good agreement, well supporting the analytical modeling. On this basis, the chemical etching rate and the etching time are simulated as a function of the boron diffusion depth in silicon for various etching solutions and etching conditions, providing suitable guiding curves for practical applications in the bulk micromachining technology*

Keywords: bulk micromachining technology**;** analytical modeling; boron diffusion in silicon; BBr3 source: high concentration profile; etching rate simulation: etching time simulation.
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1. Introduction

The bulk micromachining technology is based on the selective etching of silicon to obtain micro-mechanical elements, like various types of silicon sensors [1], particularly capacitive pressure sensors for biomedical applications [2] and accelerometers, actuators and other micro-mechanical structures [1]. The etching technique is based on the property of alkaline type solutions (KOH, NaOH, LiOH) or EDP (ethylene-diamine-pyrocatechol), to decrease the etching rate in the boron-doped layers, especially in layers with a doping levels exceeding values of the order of 10^{20} cm^{-3} [3]. However, as it was previously shown, the distribution of the boron concentration in silicon depends on the diffusion source and on the diffusion depth, so a distinct analysis of the etching process should be applied in each distinct case. Such an analysis was reported for boron doped layers after diffusion from solid boron nitride BN source [4] and for boron implantation

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