Sensors and Materials, Vol. 6, No. 6 (1994) 349-358
MYU Tokyo

S & M 0178

Amorphous Silicon Carbide and Its Application in Silicon Micromachining

A. Klumpp, U. Schaber, H. L. Offereins, K. Kühl and H. Sandmaier

Fraunhofer Institute for Solid State Technology
Hansastraße 27d, D-80686 Munich, Germany

(Received December 17, 1993; accepted March 28, 1994)

Key words: silicon carbide, PECVD, a-SiC, liquid precursor, hexamethyldisilane, chemical composition, film stress, etch resistance, step coverage, micromachining

A new passivation material for application in microsystem technologies is presented for the first time. Silicon carbide is known to have good chemical resistance and mechanical properties. The deposition of the layers reported in this paper was performed in a parallel-plate plasma reactor with hexamethyldisilane. The hexamethyldisilane was supplied by a liquid bubbler line and argon was used as carrier gas to provide a sufficiently high flow of gas. The main deposition parameters investigated are temperature and RF power. These parameters had the most direct influence on the layer properties compared to other parameters such as total flow, RF frequency and total pressure. In addition to the primary results such as deposition rate, homogeneity and step coverage, other important properties for application were stress in the layers and their etch resistance. These properties were investigated in relation to the chemical composition of the amorphous silicon carbide. The amount and kind of stress (compressive or tensile) influenced the adhesion of the layers to different materials, as well as the application as membranes. Tempering of the carbide at 450°C and 1000°C was also included in our investigations, even though the latter temperature was not compatible with processing of aluminium.

1. Introduction

A new plasma-enhanced chemical vapor deposition (PECVD) method to produce amorphous silicon carbide (SiC) films using a liquid source instead of source gases such as silane (SiH_4) and methane (CH_4) is presented.[1] By the use of hexamethyldisilane ($C_6H_{18}Si_2$) as a liquid precursor, this process is rendered nontoxic and nonhazardous. There is no