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Photo-Induced Preferential Anodization for Micromachining

Takashi Yoshida, Takahiro Kudo and Kyoichi Ikeda

Devices Laboratory, Yokogawa Electric Corporation
2-32-9 Naka-cho, Musashino-shi, Tokyo 180, Japan

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Photo-induced preferential anodization (PIPA) for fabrication of monocrystalline micromechanical structures has been previously presented. P-type silicon formed in an n-type substrate is preferentially anodized in an aqueous solution of hydrofluoric acid under illumination. This technology is based on anodization and the photovoltaic effect. PIPA has many advantages compared with conventional anodization. No metal electrode is needed for biasing the silicon wafer, so the wafer is free from the contamination of metallic ions and is very small, hence isolated p-type regions can be anodized when light is supplied to the wafer. In experiments, the dependence on light intensity, HF concentration, load resistance and ratio of the pn-junction area to the entrance area of HF solution was investigated. Consequently, it was found that porous silicon conditions depend on light intensity and HF concentration, and that anodic current density generated by a pn-junction is the most important factor for controlling PIPA. A monocrystalline microbridge structure was formed using this technology. The microbridge was 1 micron thick, 20 microns wide and 300 microns long.

1. Introduction

Anodization is the phenomenon which occurs during anodic biasing in some solutions, such as hydrofluoric acid and alkaline. Anodization in aqueous solutions of hydrofluoric acid is dealt with in this paper. It has two different aspects depending on anodic current density and HF concentration: 1) electropolishing[1] and 2)