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Thermal Diffusivity of Heavily Doped Low Pressure Chemical Vapor Deposited Polycrystalline Silicon Films

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The thermal diffusivity of heavily doped low-pressure chemical vapor-deposited (LPCVD) polycrystalline silicon films is measured using polycrystalline silicon microbridges. The thermal diffusivity is extracted from the time dependence of the resistance of electrically heated microbridges in a high-vacuum chamber. The resistance decay is measured by heating the microbridge on a half cycle of a square wave and monitoring its resistance change in the other. The diffusivity obtained using this technique is 0.17 ± 0.01 cm^{2}s^{-1}, a value consistent with previous measurements of the thermal conductivity.[1,2]

1. Introduction

The thermal diffusivity of heavily doped LPCVD polycrystalline silicon films is an important parameter in the design of polycrystalline-silicon-bridge flow sensors,[3-6] since diffusivity is needed to compute their transient response. We describe an experiment carried out to determine this parameter through the use of electrically heated microbridge resistors. Figure 1 shows the cross section and top view of a polycrystalline-silicon microbridge of the type used in our experiments. Bridges of three different lengths (180, 230, and 280 μm) made of polycrystalline silicon measuring 1.3 μm in thickness and 3 μm in width were elevated 3 μm above the silicon substrate.