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Sensor Applications for Synthetic Polycrystalline Thin-Film Diamond

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Several sensor applications for synthetic thin-film diamond are presented. A gas flow sensor using a microstructured diamond hot wire is reported. The dynamic response is characterized experimentally for diamond vs silicon and also using a finite-element model, and diamond is shown to offer faster step response by more than a factor of two for one design. In addition, diamond is expected to offer advantages for use in corrosive environments. Also reported are two accelerometer structures based on a diamond piezoresistive cantilever beam with a silicon frame and proof mass.

1. Introduction

A great deal of interest has focused on the unusual combination of extreme mechanical, electrical, thermal, optical, and chemical properties of natural diamond over the years. The recent renewal of interest in CVD synthetic diamond has led to the widespread capability for producing coatings of polycrystalline diamond. These films have values of electrical resistivity, thermal conductivity, elastic modulus, etc., which in many cases approach the extremes of natural single-crystal diamond. One application area, protective and abrasive coatings, has begun to attract commercial interest, while a second area, diamond substrates for electronic devices, awaits the development of thick, single-crystal films. In this paper, we report on work in a third area of application, the use of microstructured diamond films as active sensor components.