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Microsensor for *In Situ* Thermal Conductivity Measurements of Thin Films

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A new microsensor for the measurement of thermal properties (thermal conductivity, thermal diffusivity, specific heat capacitance) of thin films is presented. The low-cost microsensor is batch-process fabricated by standard IC technologies and micromachining. Measurements of the heating power and the resistance change of a bolometer stripe yield the thermal film properties, and can be performed with high accuracy. The application of the sensor in vacuum bell jars enables *in situ* measurements of the thermal conductivity of a growing film during the deposition. The results show the thermal conductivity of thin metal films (silver, aluminum) and the very high sensitivity of the sensor even for extremely thin films in the coalescence state. We report, for the first time, the measurements which demonstrate experimentally the validity of the Wiedemann-Franz law for very thin aluminum films.

1. Introduction

The determination of the thermal transport properties of thin films is of great interest both for understanding the structure and conduction mechanism and for numerous technical applications of these films. These properties are crucial for the design of thermal and thermomechanical microsensors and actuators. Usually the film properties differ considerably from the bulk properties. Therefore, the modelling and design of microsensors and actuators with thermal principles of operation are based on reliable film parameters. Investigations of process-specific thermal film properties are presented in refs. 1 – 5.

Many thin-film devices can be improved by optimization of the thermal conductance.