



Microelectronics Grade Metal Substrate and Related Metal-Embedded Devices

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WARF: P05140US

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a novel method of creating a microelectronics-grade metal substrate with embedded sensors.

Overview

Embedding sensors into a mass of material allows them to assess the material in a way that is not often possible with surface-mounted sensors. In addition, it is frequently necessary to embed sensors because they cannot be mounted to the outside of many types of devices, including molds, drill bits, cutter bits, turbine blades, pressure vessels, or pipes.

Current techniques for embedding sensors have several drawbacks, such as requiring the sensors to be fabricated directly into the metal tooling components, or using commercially available metal substrates with surface discontinuities that render them unsuitable for microelectronics-grade use.

The Invention

UW-Madison researchers have developed a novel method of creating a microelectronics-grade metal substrate with embedded sensors or other microelectronic devices. The metal substrate is formed on a sacrificial silicon substrate. An adhesion layer is deposited on the sacrificial substrate, followed by a seed layer of the metal. The metal material is then deposited on the seed layer via a low-temperature, low-stress process, such as electroplating, to form a microelectronics-grade substrate. Thin film sensors and/or other microelectronic devices, followed by the appropriate insulating layer(s), may be fabricated on the sacrificial substrate before the metal substrate is formed. The sacrificial silicon substrate is then etched away, leaving the microelectronics-grade metal substrate and possibly the microelectronics device. Finally, an insulating layer(s), followed by an adhesion layer, a seed layer, and additional amounts of the metal substrate, are deposited over the now exposed microelectronics device to encapsulate it within a metal shell. The encapsulated sensor and microelectronics-grade metal substrate are then ready to be embedded in high-melting temperature bulk material.

Applications

- Electrical, optical and other embedded sensors

Key Benefits

- Provides a relatively inexpensive means of obtaining high-quality microelectronics-grade metal substrates with minimal surface defects or discontinuities
- Sensors are fabricated on a silicon substrate, rather than directly on metal
- May enable mass production of electrical, optical, or other sensors for embedded sensing applications
- Suitable for high-temperature applications
- Does not require fabrication directly on the tooling itself, so the entire metal die tool does not have to be in a clean room

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- Use of insulating layers and metal embedding protects sensors from hostile external environments found in real-world industrial processes

Tech Fields

- [Analytical Instrumentation, Methods & Materials : Sensors](#)
- [Engineering : Micro & nanotechnologies](#)

For current licensing status, please contact Michael Carey at mccarey@warf.org or 608-960-9867

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