National Aeronautics and Space Administration

NASA Langley's
Flexible High-Temperature Thermocouple

Silver electroplated film shows volume resistivity approaching that of the pure metal, which offers greater current carrying capabilities and electrical conductivity.

NASA Langley has extensively studied self-metallized polyimide films for aerospace applications. These thin films have shown promise not only as reflective coatings but also conductive coatings. NASA believes that its technology may offer advantages to sensor companies, especially thermocouples as the conductive films show a volume resistivity approaching the pure metal. Specifically, NASA offers a process for producing metallized polymer films with thick conductive metal coatings.

Benefits

- High use temperature and flexible/conformable due to use of polyimide film substrate
- Increased conductivity and better heat transfer because the polyimide substrate has metal particles embedded
- Tailorable, based on the potential to use varied materials in bi-layers enabling manufacture of thermocouples with improved performance at extended temperature regimes
- Improved processing based on fewer steps, resulting in decreased processing time and expense

partnership opportunity

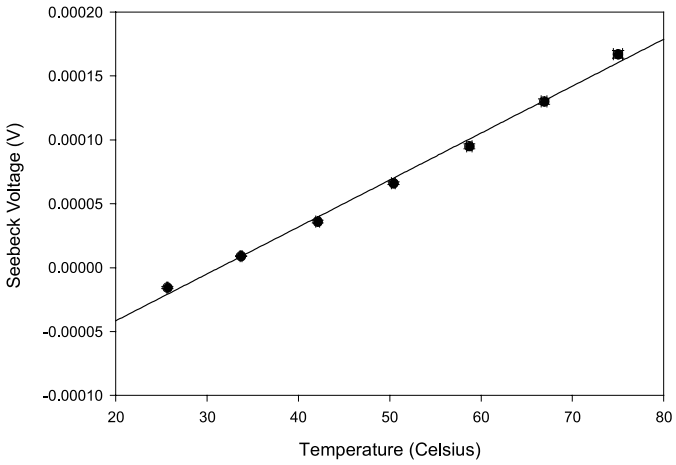
The Technology

Work to date has been performed with polyimides, but the technology is expected to work with a variety of solvent castable polymers, as well as a variety of metal coatings, including silver, palladium, copper, and aluminum. The process is simple, readily scalable, does not employ vacuum processing, does not require a separate step for surface preparation or deposition of a tie-coat, and provides excellent adhesion. Functionally the invention creates a metal tie-coat as part of the plastic film casting and curing process. The as-processed self-metallized film is then subjected to electroplating using the self-metallized layer as an electrode in order to build up substantial thickness of high quality metal film. It is believed that the entire process of film formation and electroplating could be run in a continuous fashion.

Three patent applications pending.

Applications

The conformable nature of this sensor enables it to be located in tight spaces and also around complex shapes where monitoring would otherwise be difficult. In automotive, it could apply to "under the hood" sensing; in aeronautics, it could offer benefit on structures and areas of high thermal load; and in industrial monitoring, it lends itself to extreme environments. Other applications might include capacitors, flexible circuit boards (flex circuits), varied sensors, antennas, and EMI shielding.



Results from testing prototype thermocouple showing linear correlation between temperature and Seebeck Voltage

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

The Technology Gateway

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