treated successfully include aluminum, glass, a corrosion-resistant nickel alloy, stainless steel, titanium, and poly(tetrafluoroethylene). Antimicrobial agents that have been successfully immobilized include antibiotics, enzymes, bacteriocins, bactericides, and fungicides. A variety of linkage chemistries were employed. Activity of antimicrobial coatings against gram-positive bacteria, gram-negative bacteria, and fungi was demonstrated. Results of investigations indicate that the most suitable combination of antimicrobial agent, substrate, and coating method depends upon the intended application.

This work was done by James R. Akse, John T. Holtsnider, and Helen Kliestik of Umpqua Research Co. for Johnson Space Center. For further information, contact the Johnson Commercial Technology Office at (281) 483-3809. MSC-23467-1

High-Operating-Temperature Barrier Infrared Detector With Tailorable Cutoff Wavelength

Novel materials allow the detector to operate at higher temperatures.

NASA's Jet Propulsion Laboratory, Pasadena, California

A mid-wavelength infrared (MWIR) barrier photodetector is capable of operating at higher temperature than the prevailing MWIR detectors based on InSb. The standard high-operating-temperature barrier infrared detector (HOT-BIRD) is made with an InAsSb infrared absorber that is lattice-matched to a GaSb substrate, and has a cutoff wavelength of approximately 4 microns. To increase the versatility and utility of the HOT-BIRD, it is implemented with IR absorber materials with customizable cutoff wavelengths.

The HOT-BIRD can be built with the quaternary alloy GaInAsSb as the absorber, GaAlSbAs as the barrier, on a lattice-matching GaSb substrate. The cutoff wavelength of the GaInAsSb can be tailored by adjusting the alloy composition. To build a HOT-BIRD requires a matching pair of absorber and barrier materials with the following properties: (1) their valence band edges must be approximately the same to allow unimpeded hole flow, while their conduction band edges should have a large difference to form an electron barrier; and (2) the absorber and the barrier must be respectively lattice-matched and closely lattice-matched to the substrate to ensure high material quality and low defect density.

To make a HOT-BIRD with cutoff wavelength shorter than 4 microns, a GaInAsSb quaternary alloy was used as the absorber, and a matching GaAlSbAs quaternary alloy as the barrier. By changing the alloy composition, the band gap of the quaternary alloy absorber can be continuously adjusted with cutoff wavelength ranging from 4 microns down to the short wavelength infrared (SWIR). By carefully choosing the alloy composition of the barrier, a HOT-BIRD structure can be formed. With this method, a HOT-BIRD can be made with continuously tailorable cutoff wavelengths from 4 microns down to the SWIR.

The HOT-BIRD detector technology is suitable for making very-large-format MWIR/SWIR focal plane arrays that can be operated by passive cooling from low Earth orbit. High-operating-temperature infrared with reduced cooling requirement would benefit space missions in reduction of size, weight, and power, and an increase in mission lifetime.

This work was done by David Z. Ting, Cory J. Hill, Alexander Soibel, Sumith V. Bandara, and Sarath D. Gunapala of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

Innovative Technology Assets Management
JPL
Mail Stop 202-233
4800 Oak Grove Drive
Pasadena, CA 91109-8099
E-mail: iaoffice@jpl.nasa.gov

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