Argonne NATIONAL LABORATORY

Office of Technology Transfer

TES MICROBOLOMETER IMPROVED METHOD FOR BROAD BAND IMAGING

FEATURES

- Reduced sensor complexity
- Scalable to large array sizes
- Broad Bandwidth
- High sensitivity
- High energy resolution

STATUS

A proof of concept of the scanning subsystem was demonstrated using the laser probe to selectively stimulate coordinate sensitivity on a Y-Ba-Cu-O high temperature superconducting film patterned in 40 micron wide by 3 millimeter long meander-like sensor structure. Subsequent development will focus on the fabrication of the advanced single element TES sensor and integration of the sensor, optics and an LED electronic scanning system.

COLLABORATION

Argonne is actively seeking commercial partners and licensees for further development of TES microbolometer detection methods for a range of applications.

Argonne has invented a new method for controlling the coordinate sensitivity of transition edge superconducting (TES) microbolometer detectors. This enables the creation of large array, highly sensitive TES devices. The method applies to TES microbolometers that require either array or multiplexed architecture to form an image. At liquid nitrogen cooling level (above 77 K), commercial multiplexed readout arrays are available; however, the sensitivity of these detectors is limited by infrared background noise of surrounding circuitry. In the infrared region, these sensors perform acceptably, but at increased wavelengths (such as terahertz frequencies) the sensitivity degrades due to infrared background noise. The Argonne detection method achieves an efficient and yet simple readout and removes the circuitry that creates the interfering infrared noise, decreasing sensor complexity while simultaneously improving sensitivity.

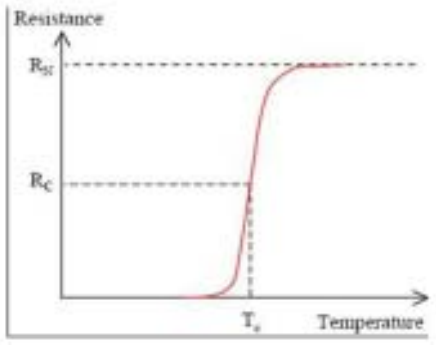

Figure 1. TES Microbolometer Thermal Response

Transition Edge Superconducting Microbolometers

Transition edge superconductors (TES) are a family of devices that exhibit a sharp change in resistance around a transition temperature (T_c in Figure 1). A TES microbolometer is cooled to its transition temperature, where it then exhibits a change in resistance when exposed to incoming radiation. TES cooled to low temperatures have high SNR and can resolve correspondingly small energy differences in incident radiation; they are therefore very sensitive devices. Many detectors, such as CCDs (Charge Coupled Detectors) or uncooled microbolometers are specialized devices that are sensitive to only a

LINKS TO ONLINE INFORMATION

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very narrow range of incident energy. TES microbolometers are very sensitive devices and can detect radiation, once converted into heat, across the entire electromagnetic spectrum.

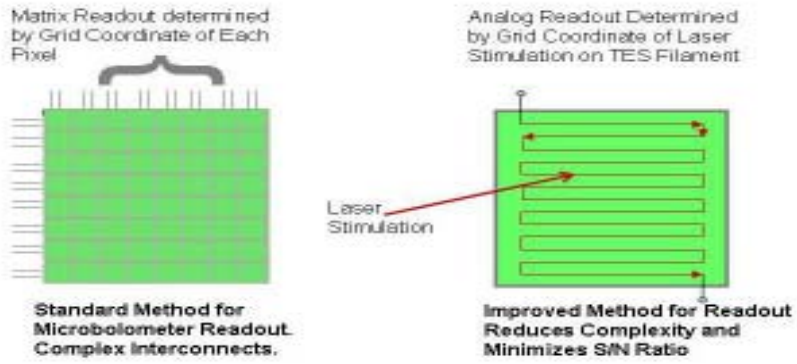

Figure 2. Conventional and Improved Imaging Sensor Configurations

How it works

Standard TES microbolometer devices have dedicated parallel readout for each pixel in the array. (Figure 2) This leads to very complex device design and read-out circuitry of the array. Argonne's new method for detection simplifies TES readout by focusing an image onto a continuous TES filament on the sensor. A laser beam is then scanned onto the element trace elevating the temperature to specified temperature in the critical temperature region. The laser beam stimulates each "pixel" serially and the image is read from only two terminals for the entire array.

Potential Applications

This method is applicable to TES microblometer devices, which are used in telescopes, defense imaging, spectroscopy and terahertz imaging applications requiring very high sensitivity and resolution.

Licensing Available

The Improved Method is available for licensing. Contact the Office of Technology Transfer to arrange for a demonstration of the technology.