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Comparison of S/N Ratios for Magnesium diboride (MgB2) Superconducting detectors vs Bi-Te thermopiles when used in infrared radiometers.

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Abstract

Mapping the surface temperature of cold Jovian moons like Europa or Ganymede requires an accurate measurement of their infrared spectral radiance. One measurement technique employs a radiometer with thermopile linear arrays. Each array is in turn integrated with infrared filters of the appropriate wavelength pass bands. The performance of such a radiometer when using an array of thermopile detectors vs an array of superconducting magnesium-diboride (MgB2) detectors.

1. Introduction

The superconducting critical temperature (Tc ~ 39K) of the simple binary, intermetallic, MgB2 (1) makes it a very good candidate for the development of the next generation of thermal sensors. Such sensors would provide higher S/N ratio and are ideal candidates to replace the current Bi-Te based thermopile detectors used in infrared radiometers. With a D* of the order of $\geq 2x10^{10}$ $cmHz^{1/2}/W$ superconducting MgB2 detectors are an order of magnitude more sensitive than thermopiles (3). They can also be tailored to have ½ the time constant of the stare-of-the art thermopiles.

2. Figures

Below, we compare the S/N ratios as a function of scene temperatures expected at Europa and other icy moon for typical radiometer channels used to investigate such moons. The MgB2 thermal detector was developed at NASA/Goddard. The thermopiles are produced by Institute of Photonics, Jena (Germany).

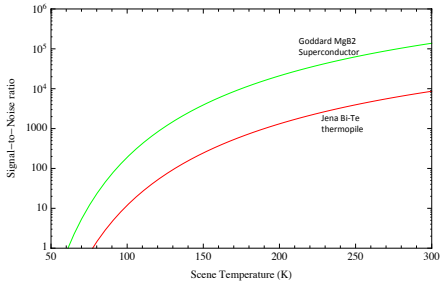

Figure 1: S/N Ratio for 8-20µm channel – MgB2 vs Bi-Te thermopile

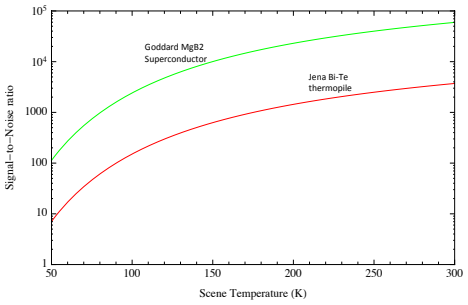

Figure 2: S/N ratio for 20-100 µm channel - MgB2 vs Bi-Te thermopile

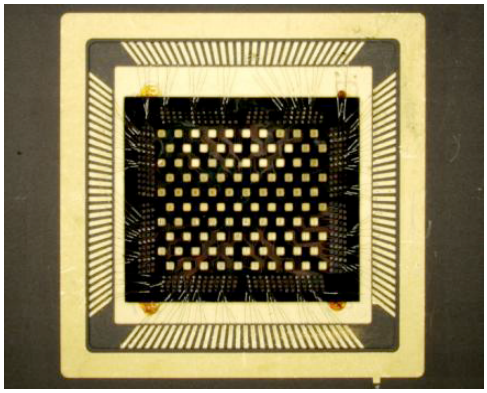

Figure3: 2-D array of Magnesium Diboride thermal detectors developed at NASA/Goddard.

4. Conclusions

MgB2 thermal sensor arrays provide a much better S/N than thermopiles. They require however active cooling. Significant progress is being made in the cryo-cooling arena to develop low mass low power miniature coolers. We believe that infrared radiometers to be flown to the outer planets and/or icy moons in the next decade will carry cryo-cooled MgB2 detectors at their focal planes.

5. References

1- J. Nagamatsu *et al., Nature*, vol. 410, pp. 63-64, 2001.
2- B. Lakew, S Aslam et al., *Physica C* . 483 119-126, 2012.
A. Ihring et al., SENSOR+TEST-Konferenzen-2009_IRS-2009_I1.3-Proceedings-OPTOIRS22009-1