SPIE Defense, Security + Sensing, Baltimore 2014

Improved high operating temperature MCT MWIR modules

H. Lutz*, R. Breiter, H. Figgemeier, T. Schallenberg, W. Schirmacher, R. Wollrab
AIM INFRAROT-MODULE GmbH, Theresienstr. 2, 74072 Heilbronn, Germany

High operating temperature (HOT) IR-detectors are a key factor to size, weight and power (SWaP) reduced IR-systems. Such systems are essential to provide infantrymen with low-weight handheld systems with increased battery lifetimes or most compact clip-on weapon sights in combination with high electro-optical performance offered by cooled IR-technology.

AIM's MCT standard n-on-p technology with vacancy doping has been optimized over many years resulting in MWIR-detectors with excellent electro-optical performance up to operating temperatures of ~120K. In the last years the effort has been intensified to improve this standard technology by introducing extrinsic doping with Gold as an acceptor. As a consequence the dark current could considerably be suppressed and allow for operation at ~140K with good e/o performance. More detailed investigations showed that limitation for HOT > 140K is explained by consequences from rising dark current rather than from defective pixel level.
Recently, several crucial parameters were identified showing great promise to further optimization of HOT-performance. Among those, p-type concentration could successfully be reduced from the mid 10^{16} / cm^3 to the lower 10^{15}/ cm^3 range.

Since AIM is one of the leading manufacturers of split linear cryocoolers, an increase in operating temperature will directly lead to IR-modules with improved SWaP characteristics by making use of the miniature members of its SX cooler family with single piston and balancer technology.

The paper will present recent progress in the development of HOT MWIR-detector arrays at AIM and show electro-optical performance data in comparison to focal plane arrays produced in the standard technology.

Keywords: MCT, IR-module, SWaP, high operating temperature, dark current

Short version:

High operating temperature IR-detectors are a key factor to size, weight and power (SWaP) reduced IR-modules highly required for handheld systems or clip-on thermal weapon sights.

In recent years the effort to improve AIM's MCT standard n-on-p technology with vacancy doping for HOT performance has been intensified by introducing extrinsic doping with a monovalent acceptor. Recently, further reduction of dark current could be achieved, amongst other parameters, by reducing p-type concentration to the lower 10^{15}/ cm^3 range.

The paper will present recent progress in the development of HOT MWIR-detector arrays at AIM and show electro-optical performance data in comparison to focal plane arrays produced in the standard technology.