Editorial

All objects (animate or inanimate) radiate energy, day and night. The bulk of the radiated energy for all terrestrial temperatures lies in the IR beyond the visible range, at a wavelength of 0.75 µm to the microwave region at 1000 µm. Since IR radiation cannot be detected by the human eye, it offers the opportunity to see in the dark by detecting and converting the profile of self-emitted thermal radiation of the objects into electrical signals with the help of IR detector/array of detectors, followed by the coupling to a video monitor. Being a passive method, this kind of thermal imaging of the objects by IR detectors has a great appeal for military applications. Transmission of IR radiation through 3 µm to 5 µm mid-wavelength infrared (MWIR) and 8 µm to 12 µm long-wavelength infrared (LWIR) atmospheric windows have led to the choice of IR detector materials responding in these two spectral bands/windows.

IR detection mechanisms fall into three broad classes: Photon, thermal and wave interaction. In the evolution of modern thermal imaging systems, it was the photon detectors, which played the major role. The earliest systems employed 2-D scanning mechanisms, in which a single detector scanned the entire image in one frame of time. Thus, very fast detector response typically in the microsecond range was required. Later, systems employed linear detector arrays with 1-D scan. Although the speed of response requirement reduced, nevertheless only photon detectors could meet both sensitivity and speed of response requirement. These early systems operated in 3 µm to 5 µm MWIR window and have thus shown limited performance characteristics due to low thermal radiance in MWIR band at ambient temperatures. The activity on advanced thermal imagers got the real boost with the arrival of *HgCdTe* detectors, which operated in 8 µm to 12 µm window, followed by the advent of 2-D arrays and staring focal plane arrays (FPAs).

Driven by the need of developing advanced thermal imagers with very high performance levels, the last three decades have been marked with intensive research on *HgCdTe* along with the emergence of several new ideas and technologies. These include some of the developments of FPAs based on *PtSi, IrSi, InSb, PbSnSe, Si-Ge* alloys, *GaAs/AlGaAs*-based QWIP detector arrays.

With the evolution of staring FPA concept, the frame time and the pixel response time could become the same, obviating the need of very fast response detectors. Thus, it became possible to consider approaches other than those employing photon detectors, all of which require cryogenic operation. In the last decade, the room temperature operated resistive bolometer arrays, pyroelectric arrays and the thermoelectric arrays have made remarkable progress in providing an alternative low-cost thermal imaging solution for several civilian and internal security applications. The sensitivity of the thermal imagers based on this low-cost solution is obviously less compared to photon detector-based thermal imagers.

Given the limited space and enormity and vastness of the field of *IR materials and detectors for thermal imaging*, it was entirely impossible to cover all the aspects in this Special Issue. However, only a humble attempt has been made by presenting the invited articles written by experts in their own areas.

I would like to take this opportunity to thank all the contributors, who very kindly agreed to contribute articles on my request. I am also grateful to Dr Mohinder Singh, Director DESIDOC and the Editorial staff of *Defence Science Journal* in bringing out this Special Issue.

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