

Vacuum-deposited Bismuth thin films for high-performance, ultra-broadband photodetectors based on photothermoelectric effect

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High-performance photothermoelectric photodetectors based on vacuum-evaporated elemental Bi thin films, which may find widespread applications ranging from ranging to remote imaging. Thanks to its gap-less semi-metal nature, the detector works well over broad spectrum, ranging from ultra-violet to mid-infrared. Employing heat sink layer beneath Bi film has enabled remarkable reduction in response time by enhanced thermal diffusivity, with marginal decrease in responsivity. In addition, surface nanostructuring for light trapping and metal-insulator-metal(MIM) Fabry-Perot cavity could further enhance the responsivity. Flexible and stretchable broadband photodetectors have also been demonstrated, enabling detectors conformable onto complex and curvilinear surface. As a proof-of-concept demonstration, simple 2D imaging with arrays of photodetectors has been demonstrated. The Vi-based photodetectors, based on simple and low-cost materials and processes, may find applications in robotics, and outdoor navigations, etc.