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The Fabrication of Unclassified Photodetctors in Iraq

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In this review the results of many unclassified homemade optical detectors developed in the last two decades at the research and patents bases in Iraq is demonstrated. These detectors include: CdS doped with Cu (CdS:Cu); CdSe; CdSe:Cu; PbS; and PbSe. They cover a wide range of the electromagnetic spectrum ranging from the solar spectrum to the infrared (0.4–10.6 μm). It is found that for the CdS and CdSe type of the detectors, the wavelength tuning are due to the localized energy states of copper atoms inside the valence and conduction band of the CdS and CdSe. The tuning of these photoconductive detectors is compared with the recent quantum well (QWIR) and quantum dots (QDIR) infrared detectors. The major significance of the developed detectors is their synthesis simplicity and very low cost in comparison with that of the QWIR and the QDIR detectors. The CdS:Cu which covers the spectral response range (0.4–0.7 μm) is prepared by using a chemical spray pyrolysis. The CdSe:Cu is found to cover a wider spectral response than that of the CdS:Cu (0.4–10.6 μm). This detector is prepared by vacuum evaporation of CdSe films on glass substrate followed by vacuum annealing under an argon atmosphere for doping of copper. A high gain value of 2.37–107 is measured and explained by the competition of the copper capture cross section. Such competition produces further carriers due to the photoexcitation of copper atoms in the localized states inside the band gap. For the CdSe detector, it is found that vacuum annealing improves the detector characteristics such as the gain. Moreover it is found that the gain increases from 4.3 to 12 when the annealing temperature was increased from 150 to 350°C respectively. However, the doping of CdSe with copper leads to a huge increase of the gain coefficient to about 9–103. On the other hand the PbxS1-x alloys (spectral response 1–2.8 μm) were prepared from pure lead and sulfer powders with two x contents (0.54, 0.55). They were loaded into a clean and baked quartz tube. It is found that the quantum efficiency, responsivity and detectivity of the prepared detector are improved with the little increase of the Pb content from 0.54 to 0.55. As for the PbSe film detector (response range 2–5 μm), the responsivity and quantum efficiency are found to increase by lowering the detector temperature to 180K. It is focused on a brief review of the figure of merits of the mentioned detectors. Moreover these detectors are used for the detection of various laser wavelengths in a pulsed mode of operation and can be used in military areas, particularly, for the detection of thermal targets.

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