Effect of Temperature on the Electrical Properties of CdTe Radiation Detector

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Abstract. Cadmium telluride (CdTe) is a widely used semiconductor material for room-temperature radiation detection due to its high atomic number and suitable bandgap. However, its electrical properties are known to be sensitive to temperature variations, which can influence detector performance. This study investigates the temperature-dependent behavior of key electrical parameters, including the leakage current, the barrier height, the ideality factor and the series resistance, in CdTe-based radiation detectors. In this study, CdTe radiation detectors were fabricated using two different metal–semiconductor–metal (MSM) configurations. The first structure employed an In/Ti Schottky contact on one side of the CdTe substrate and an ohmic Pt contact on the opposite side, while the second configuration used ohmic Pt contacts on both sides. To investigate the influence of temperature on electrical behavior, current–voltage (I–V) characteristics were measured under both forward and reverse bias. The measurements were conducted over a temperature range from 0 °C to 120 °C, allowing for detailed analysis of thermally induced changes in charge transport and detector performance. The measured current increased with rising temperature, indicating enhanced thermal generation of charge carriers and a temperature-dependent conductivity mechanism in the CdTe detector structures.