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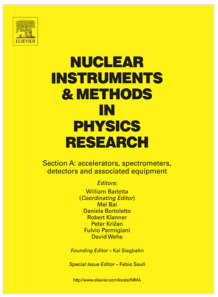

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Low leakage current Ni/CdZnTe/In diodes for X/γ-ray detectors

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Abstract

The electrical characteristics of the Ni/$Cd_{1-x}Zn_xTe$/In structures with a metal-semiconductor rectifying contact are investigated. The diodes, fabricated on the base of In-doped *n*-type $Cd_{1-x}Zn_xTe$ (CZT) crystals with resistivity of ~10^{10} Ω·cm, have low leakage current and can be used as X/γ-ray detectors. The rectifying contact was obtained by vacuum deposition of Ni on the semiconductor surface pretreated with argon plasma. The high barrier rectifying contact allowed us to increase applied reverse bias voltage up to 2500 V at the CZT crystal thickness of 1 mm. Dark (leakage) currents of the diodes with the rectifying contact area of 4 mm^2 did not exceed 3-5 nA at bias voltage of 2000 V and room temperature. The charge transport mechanisms in the Ni/CZT/In structures have been interpreted as generation-recombination in the space charge region within the range of reverse bias of 5-100 V and as currents limited by space charge at both forward and reverse bias at $V > 100$ V.

Keywords: semi-insulating CdZnTe, Ohmic contact, rectifying contact, Schottky diode, *I-V* characteristic, space charge limited current

1. Introduction

Cadmium telluride (CdTe) and its solid solution $Cd_{1-x}Zn_xTe$ (CZT) are the most important semiconductor materials for fabrication of spectroscopic X/γ-ray detectors operating without cryogenic cooling particularly in a significant photon energy range higher than 30-50 keV [1-3]. The main disadvantage of such detectors is incomplete charge collection hence, a decrease in energy resolution [4, 5]. An increase in bias voltage, applied to the detector,