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用于 α 粒子探测的 4H-SiC 肖特基势垒二极管的温度特性研究

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Schottky barrier diode (SBD) radiation detectors were fabricated by 20μm thick n-type 4H-SiC epitaxial layers for α particles detection. The forward and reverse current-voltage (I-V) characteristics, over a wide temperature range of 298-423K, were obtained on Ni/4H-SiC SBD detector. The reverse leakage current values of detector are almost unchanged in temperature 298-398K, revealing a possibility of operating at high temperature. Based on thermionic emission (TE) theory, the forward I-V analysis of detector indicates an increase of the barrier height and a decrease of the ideality factor when the temperature increases, and the obtained Richardson constant value is 6.899Acm-2K-2, which is much lower than theoretical value of 146Acm-2K-2. These anomalies are mainly ascribed to the barrier height inhomogeneity at the Ni/4H-SiC interface. The effective barrier height value of 1.544eV obtained from the forward I-V-T data, matches with the barrier height of 1.552eV from capacitance-voltage (C-V) measurement. The mean barrier height of 1.729eV and the standard deviation of 74.330mV are obtained from the plot of apparent barrier height versus q/2kT by assuming a Gaussian distribution of the Schottky barrier heights. The mean barrier height is found to be 1.728eV, which is good in line with the one calculated from Gaussian distribution. The modified Richardson constant is calculated as 141.383Acm-2K-2, which is much closer to the theoretical value.

Primary author: Dr 杜, 园园 (中国科学院高能物理研究所)

Co-authors: Mr MENG, Bin (中国科学院高能物理研究所); Dr ZHANG, Chunlei (中国科学院高能物理研究所); Dr LUO, Tao (中国科学院高能物理研究所); Dr CAO, Xuelei (中国科学院高能物理研究所)

Presenter: Dr 杜, 园园 (中国科学院高能物理研究所)

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