

Studies of Quantum Dot Infrared Photodetectors

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Abstract

We study the influence of charges in QDs on the characteristic of the device. The charges in QDs can not freely move, not the same as the ones in QWs. The influence of Coulomb force caused by these charges can divide into two parts.

The first part study the charges in QDs how to influence the transition characteristic, the dependence of photo response and temperature. In QWIPs, it has been confirmed that the responsivity in most devices are temperature-independent.

The second part study the influence of charges on frequency response. In order to explain the phenomenon showed in QDIP, the QWIP model is utilize to explain the behavior in QDIP. From the experiment result, the photo response of QDIP is decrease as the frequency increase. It is interesting that this phenomenon also showed in dark current noise. According to the QWIP model which proposed by other groups, the current contains two component of current, which are fast transient and slow transient. The fast transient comes from the photocarriers generated from the QW. The photocarriers from the QWs induce the local positive charge and thus the slow current component which is injected from the contact to compensate the positive charge in the QWs. We modify the QWIP model to fit the characteristic of our QDIP. Although we can not determine quantitatively to find the equation, we can understand the reason of inaccuracy.