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Abstract:

Compared with traditional infrared (IR) photodetectors, cascade IR up-converters (CIUPs) have the advantages of pixelless imaging without bonding to read-out circuits and low background luminescence. However, the required transparent electrode is one of the issues which limiting the device performance. In this work, CIUPs with metal grid electrodes are proposed to improve the IR detection performance. Devices fabricated using metal grid electrodes with different aperture opening ratios (AORs) and transparent electrode are compared. The experimental results show that, by adopting the metal grid electrode, the ohmic contact characteristics and the up-conversion system efficiency can be improved. Specially an increase of 117% in the up-conversion system efficiency and an increase of 30% in the internal quantum efficiency (IQE) of CIUP light-emitting section have been achieved for the device with an AOR of 80%. Secondary ion mass spectrometry (SIMS) and temperature-dependent photoluminescence (TDPL) measurements reveal that utilizing the metal grid electrode can reduce the diffusion effect of electrode metals, which is beneficial to improve the IQE of infrared up-converters.

Key words

Quantum cascade transport, Infrared up-conversion, Metal grid electrode

Internal quantum efficiency, Metal diffusion

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