

課題番号 : F-13-TT-0011
利用形態 : 共同研究
利用課題名 (日本語) : MBE による InAs 量子構造の作製
Program Title (English) : Fabrication of InAs quantum structures with molecular beam epitaxy
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1. 概要 (Summary)

In general, photon or carrier upconversion mechanism allows converting low energy photons to high energy carriers or photons. Highly efficient upconversion mechanisms can be useful for many devices, such as infrared detectors, lasers or third generation solar cells, such as the intermediate band solar cell [1]. The intermediate band solar cell concept aims at reducing absorption losses of infrared photons by absorption and subsequent upconversion in intermediate states, which are embedded in bulk material such as GaAs or AlGaAs. InAs quantum dots have been widely used to realize intermediate states in bulk material. We studied the highly efficient upconversion in InAs disk-like quantum structures which are formed in early stages of InAs deposition [2,3]. We recently also elucidated the influence of the interactions between quantum dots and disk-like structures on the upconversion efficiency [4,5]. This program aims at obtaining results to fortify previous results by performing measurements on samples prepared with different growth conditions.

2. 実験 (Experimental)

We used molecular beam epitaxy (facility: modified EIKO) to fabricate an undoped sample structure for investigating the operating principle of intermediate state solar cell based on InAs disk-like quantum structures. A single InAs layer with deposition amount below critical thickness for quantum dot formation was embedded in AlGaAs. Nano-disk and quantum dot structures without Al have been prepared as well.

3. 結果と考察 (Results and Discussion)

Photocurrent measurements of the InAs/AlGaAs sample have been obtained at different temperatures.

Photoluminescence measurements were performed at low temperatures. We identified photocurrent due to resonant absorption of photons in shallow InAs/AlGaAs quantum structures for energies above and below the GaAs bandgap energy. We had already shown the differences of upconversion in samples with and without InAs [2,6]. The present result serves as further supporting evidence that the strong PC generation observed in our publications [3-5] is from the InAs layer and not from impurities in GaAs.

4. その他・特記事項 (Others)

・参考文献

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- [6] Nanotechnology Platform Users' Report F-12-TT-0040.

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5. 論文・学会発表 (Publication/Presentation)

なし。

6. 関連特許 (Patent)

なし。