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Template method for positioning of colloidal quantum dots for optoelectronic device application

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Semiconductor quantum dot (QD) is promising for various future optoelectronic devices. In this paper, we review two of our researches about QD positioning in the field of optoelectronics. One is aimed at the quantum information device application. As the technique applicable to the production of quantum circuits and devices, we developed the method for positioning of single colloidal QDs (C-QDs). Oxidation lines on a Si substrate drawn by the scanning probe microscope were used as a negative etching mask, and the cross section of the oxidation was controlled to create a nano hole for a single C-QD trapping. The other research is aimed at the solar cell application. It has been predicted that QD-superlattice solar cell will achieve the photoelectric conversion efficiency of more than 70%. After the sedimentation of C-QDs into the pyramidal holes processed by anisotropic wet etching on a Si substrate, we observed characteristic photoluminescence from the QD sheet, which suggests the partial creation of QD superlattice. By optimizing the sedimentation conditions, we succeeded to expand the superlattice area.

Biography

Kohki Mukai received PhD in Electronics Engineering from Kyoto University, Japan. He is the Professor of Graduate School of Engineering, Yokohama National University. In 1994 he invented the method to grow the self-assembled InGaAs quantum dots (QDs) emitting at the optical telecommunication wavelength of 1.3 and 1.55 μm . In 1999 he realized the first 1.3- μm continuous-wave lasing of QD lasers at room temperature. His achievements led to the world's first establishment of QD's photonic device provider, 'QD Laser, Inc.'

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