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X-ray standing wave study of strain in a buried heterostructure

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The structure of 1 ML InAs on GaAs(001) capped with 25 Å GaAs was examined by the x-ray standing wave (XSW) method. By monitoring the In L fluorescence while scanning through the GaAs (004) Bragg reflection, the perpendicular strain within the InAs heterolayer was directly measured to be 7.7%, which is in good agreement with the macroscopic elasticity theory (7.3%) and the previously reported local density approximation calculation (7.8%). In this work, we also demonstrated that combined with the evanescent-wave emission effect, XSW can be used to measure the strain-induced cap displacement in the growth direction relative to the bulk (004) diffraction plane. This result is consistent with our directly measured strain of the InAs layer. The XSW measurements were performed at the NSLS X15A beam line.

This work was sponsored by DOE under contract No. W-31-109-ENG-38 to Argonne National Laboratory and by NSF under contract No. DMR-9120521 to the MRC at Northwestern University.