Surface compositional profiles of InAs/GaAs quantum rings

S. Heun,[1§] G. Biasiol,[2] R. Magri,[3] A. Locatelli,[4] T. O. Mentes,[4] L. Sorba[1]
[1] *NEST CNR-INFM and Scuola Normale Superiore, I-56126 Pisa, Italy*
[2] *Laboratorio Nazionale TASC CNR-INFM, AREA Science Park, I-34012 Trieste, Italy*
[3] *S[3] CNR-INFM and Università di Modena e Reggio Emilia, I-41100 Modena, Italy*
[4] *Sincrotrone Trieste S.C.p.A., I-34012 Trieste, Italy*

The composition profile of self-assembled InAs/GaAs quantum rings is studied both experimentally and theoretically. 2D surface maps obtained by X-ray photoemission electron microscopy (XPEEM) reveal a non-uniform profile with an In-rich core, corresponding to the central hole of the ring, surrounded by a rim with stronger In-Ga intermixing. These results are substantiated by an atomistic Valence Force Field (VFF) model which, for a given shape, identifies the composition distribution that minimizes the elastic energy of the system. The VFF calculation predicts a preference for the In atoms to remain localized in the ring hole, in agreement with the experimental findings.

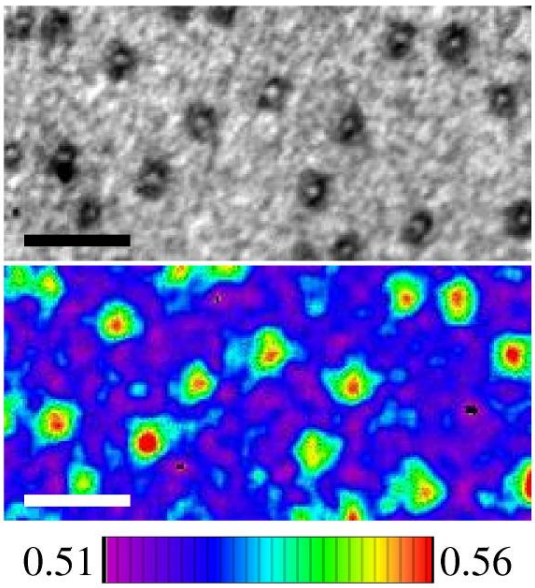

Fig. 1. a): 1000 nm x 480 nm low energy electron microscopy image of self-assembled InAs/GaAs quantum rings.
b) Surface In composition of the same area measured by XPEEM. The length markers correspond to 200 nm.

§ Corresponding author, stefan.heun@sns.it