Poster Presentation

MS103.P12

Looking into the structure of Ge nano-crystals through combined Diffraction/XAFS

Y. Zhang[1], A. Karatutlu[1], O. Ersoy[1], A. Sapelkin[1]

[1]*Queen Mary, University of London, School of Physics and Astronomy, London, UK*

Nano-particles of different materials including II-VI (ZnS, ZnO, etc.), III-V (AlN, GaN, etc.) and IV (Si, Ge, etc.) have been applied widely because of their superb optical-electrical properties. More importantly, the size & structure-dependent character of their physical properties due to the quantum confinement effect attracted much research interest during the past decades [1]. Ge is characterized by relatively large Exciton Bohr Radius (≈24nm) [3], which potentially favors the quantum confinement effects for tuning the photoluminescence (PL) properties. Besides, the low toxicity of Ge suggests potential biological applications such as cell imaging and labeling [4]. For the structure characterization of our prepared Ge quantum dots (QDs), we used the in-house X-ray pair distribution function (PDF) machine (X-ray from Ag source with wavelength down to 0.056nm) and Diamond light source synchrotron radiation source (XAFS, XRD, PL, etc.) to characterize the atomic structure. Several other methods such as TEM and SAED were used to provide a comprehensive picture of QDs on nanoscale. The results showed that our as-prepared Ge QDs are amorphous with small size, and annealing process could attenuate the Ge-O bonding. In both aged as prepared and fresh annealed samples we observed a diffraction peak corresponding to d-spacing around 2.8Å, which can be associated with either ST12 or BC8 metastable phase of Ge. Moreover, samples showing extra diffraction peaks also shows different XANES features from that of diamond Ge. The fdmnes calculation and FitIt fitting was carried out to further look into structural information.

[1] *Fan, J. Y.; Chu, P. K. Small 2010, 6, (19), 2080-2098.,* ***[2]*** *Xue, D. J.; Wang, J. J.; Wang, Y. Q.; Xin, S.; Guo, Y. G.; Wan, L. J. Advanced Materials 2011, 23, (32), 3704,* ***[3]*** *Vaughn, D. D.; Bondi, J. F.; Schaak, R. E. Chemistry Of Materials 2010, 22, (22), 6103-6108*

Keywords: Ge Quantum Dots, X-ray diffraction, XAFS