Journal of Non-Crystalline Solids
Volume 353, Issue 3, 1 March 2007, Pages 308-312

Characterizations of a-Se based photodetectors using X-ray photoelectron spectroscopy and Raman spectroscopy

Okano, K.[a b], Saito, I.[a], Mine, T.[b], Suzuki, Y.[c], Yamada, T.[d], Rupesinghe, N.[a], Amaratunga, G.A.J.[a], Milne, W.I.[a], Zahn, D.R.T.[c]

[a] Department of Engineering, University of Cambridge, Electrical Engineering Division, 9, JJ Thompson Avenue, Cambridge CB3 0FA, United Kingdom
[b] Department of Physics, International Christian University (ICU), 3-10-2 Osawa, Mitaka, Tokyo, 181-8585, Japan
[c] Halbleiterphysik, Institut fuer Physik, Technische Universität Chemnitz, Reichenhainer Str.70 /72, D-09126 Chemnitz, Germany
[d] Diamond Research Centre, National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1 Umezono, Tsukuba, Ibaraki, 305-8568, Japan

Abstract

The 'PLUMBICON' was one of the first successful imaging tubes using amorphous selenium (a-Se) and many followed. Significant properties of a-Se based imaging tubes have been rediscovered through the invention of the 'HARP (high-gain avalanche rushing amorphous photoconductor)', but its operational mechanism and the physics, however are yet poorly described. Previously, we have fabricated photodetectors using nitrogen (N)-doped diamond as a cold cathode and a-Se as a photoconducting target, which successfully responded to light illumination, The device performance,in this case, deteriorates after continuous use largely due to the degradation of a-Se. In this paper, a-Se and amorphous arsenic selenide (a-As_2Se_3) films have been deposited Stoichiometry has been determined by XPS (X-ray photoelectron spectroscopy) followed by Raman spectroscopy characterization. We have found that even an extremely weak incident laser power causes sample degradation during signal accumulation. We speculate that either the incident laser itself and/or the temperature rise due to illumination causes the phase transition in a-Se films. In addition, when As is added into the film, the phase transition leading the degradation is hardly observed, implying that As affects the formation of crystalline Se making chemical bonds in the crystallographic network stronger. © 2006 Elsevier B.V. All rights reserved.

Author Keywords

Amorphous semiconductors; Crystallization; Devices