

Copyright WILEY-VCH Verlag GmbH & Co. KGaA, 69469 Weinheim, Germany, 2012.

# NANO MICRO small

## Supporting Information

for *Small*, DOI: 10.1002/smll. 201101993

Synthesis of Nanoamorphous Germanium and Its Transformation to Nanocrystalline Germanium

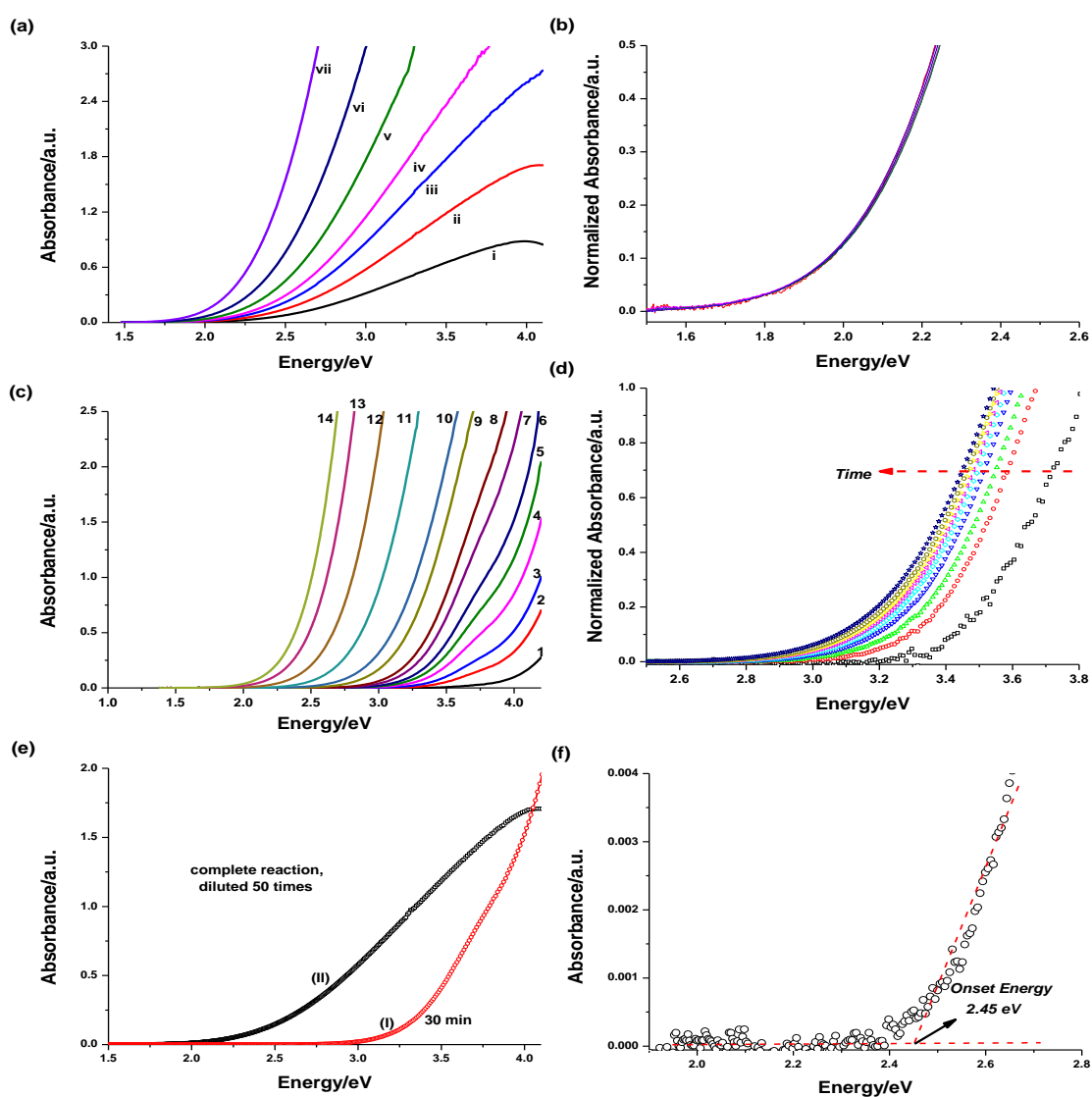
Ömer Dag , \* Eric J. Henderson , and Geoffrey A. Ozin \*

## Supporting Information

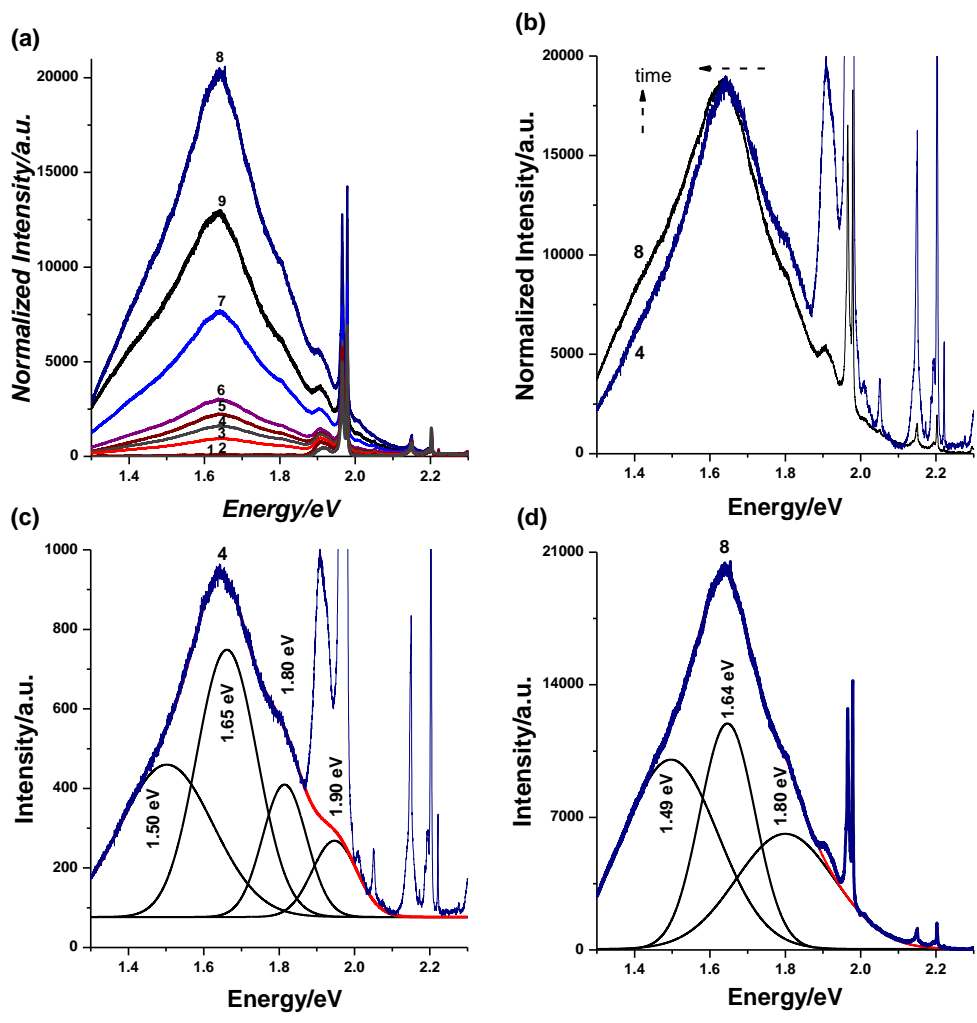
# Synthesis of Amorphous Germanium Nanoclusters and Their Transformation to Nanocrystals

Ömer Dag<sup>a\*</sup>, Eric J. Henderson<sup>b</sup>, and Geoffrey A. Ozin<sup>b\*</sup>

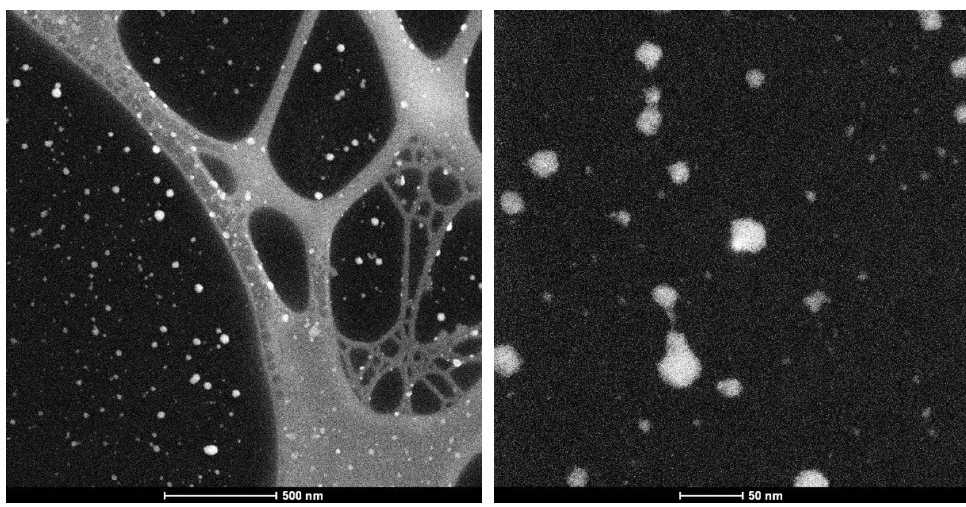
<sup>a</sup>Department of Chemistry, Bilkent University, 06800, Ankara, Turkey email: [dag@fen.bilkent.edu.tr](mailto:dag@fen.bilkent.edu.tr) <sup>b</sup>Materials Chemistry and Nanochemistry Research Group, Center for Inorganic and Polymeric Nanomaterials, Chemistry Department, 80 St. George Street, University of Toronto, Toronto, ON, Canada M5S 3H6, \*Email: [gozin@chem.utoronto.ca](mailto:gozin@chem.utoronto.ca)



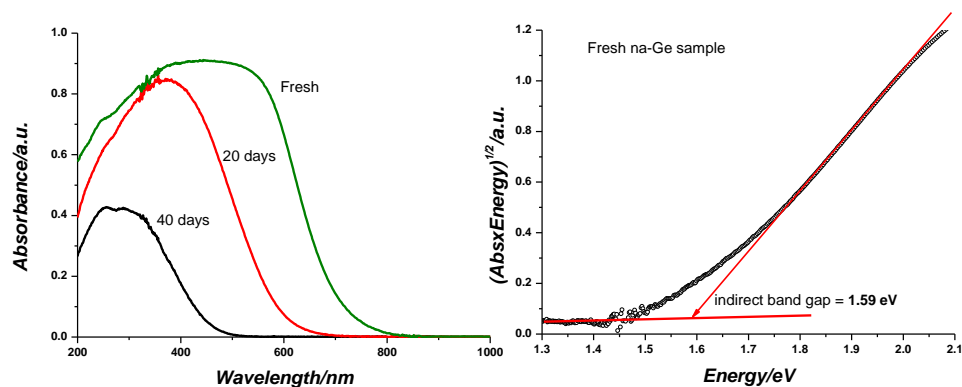
**Figure S1.** UV-Vis-NIR spectra of 0.11 ml  $\text{Ge}(\text{OCH}_2\text{CH}_3)_4$ , 0.36 ml  $(\text{CH}_3\text{CH}_2\text{O})_3\text{SiH}$  in 12 ml ethanol and 3 ml water: (a) fully reacted sample, diluted i) 300, ii) 150, iii) 100, iv) 75, v) 50, vi) 30 and vii) 15 times, (b) normalized spectra in (a), (c) time dependent spectral change (between 5 min to 5 days (1) 8 min, 2) 15 min, 3) 21 min, 4) 28 min, 5) 35 min, 6) 45 min, 7) 92 min, 8) 150 min, 9) 270 min, 10) 415 min, 11) 755 min, 12) 1170 min, 13) 3413 min, and 14) 7360 min), (d) normalized spectra 1 to 9 of (c), (e) i) of partially reacted (30 min) and completely reacted and diluted sample, and (f) indicating determination of the onset energy.



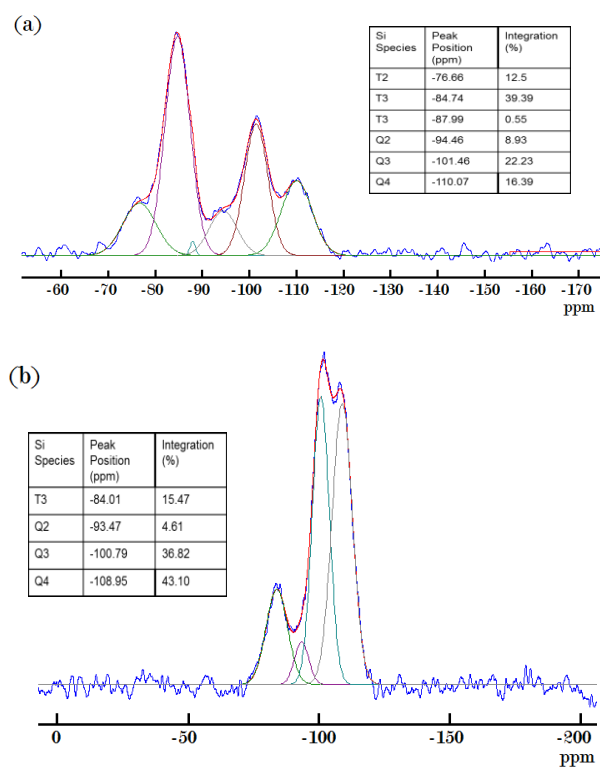
**Figure S2.** Photoluminescence (PL) spectra of a mixture of 0.11 ml  $\text{Ge}(\text{OC}_2\text{H}_5)_4$  and 0.36 ml  $\text{HSi}(\text{OC}_2\text{H}_5)_3$  in a 3 ml  $\text{CH}_3\text{OH}/0.5$  ml  $\text{H}_2\text{O}$  after (2) 45 min, (3) 100 min, (4) 140 min, (5) 190 min, (6) 265 min, (7) 28 h, (8) 95 h, and (9) 5 weeks. (a) normalized to  $\text{CH}_3\text{OH}$  (1) peak at  $1033\text{ cm}^{-1}$ , (b) normalized with respect to PL maximum of (4) and (8), and the convolutions of (c) (4) and (d)(8).



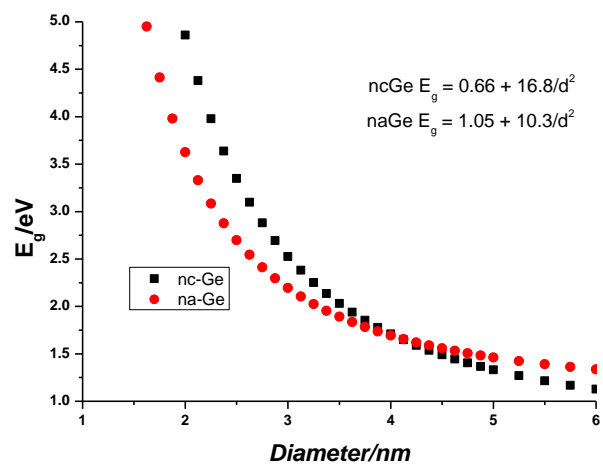
**Figure S3.** HAADF TEM images of na-Ge upon HF etching.



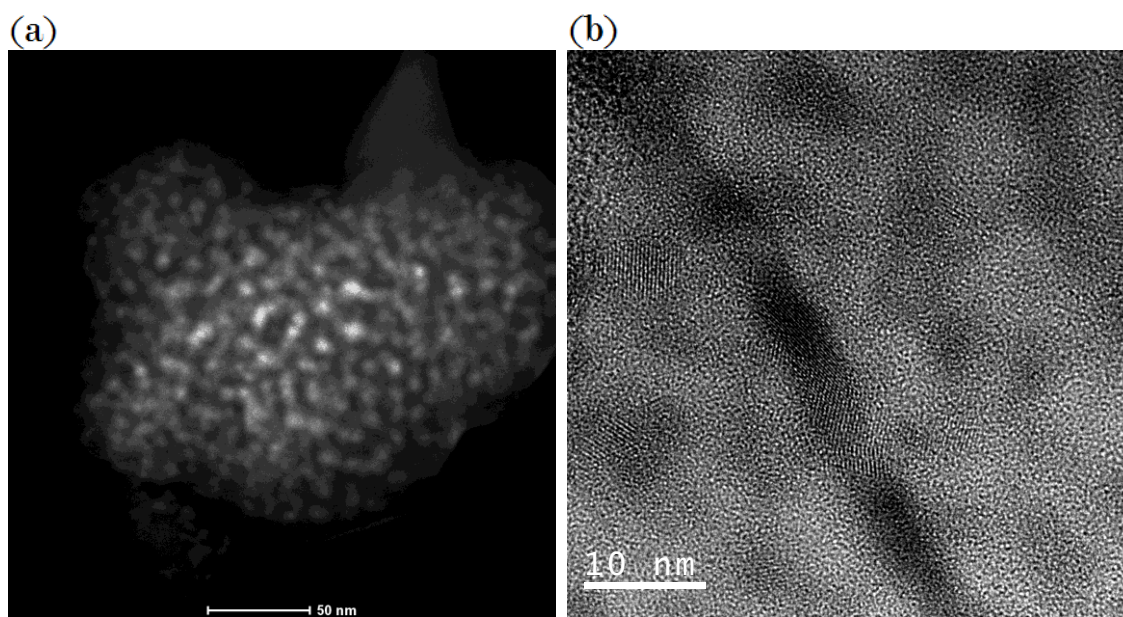
**Figure S4.** (a) Diffuse reflectance UV-Vis-NIR spectra of na-Ge/SiO<sub>2</sub> over time (as indicated in the spectra). (b) Tauc plot of the fresh sample  $((A \cdot hv)^{1/2}$  versus  $h\nu$  plot, valid for indirect semiconductors).



**Figure S5.** The <sup>29</sup>Si HPDEC MAS NMR Spectra of (a) fresh and (b) 30 days aged na-Ge/SiO<sub>2</sub> sample.



**Figure S6.** The band gap energy versus particle diameter plots of nc-Ge and na-Ge using effective mass model.



**Figure S7.** (a) HAADF TEM and (b) TEM images of the nc-Ge/SiO<sub>2</sub> recorded from different parts of the sample.

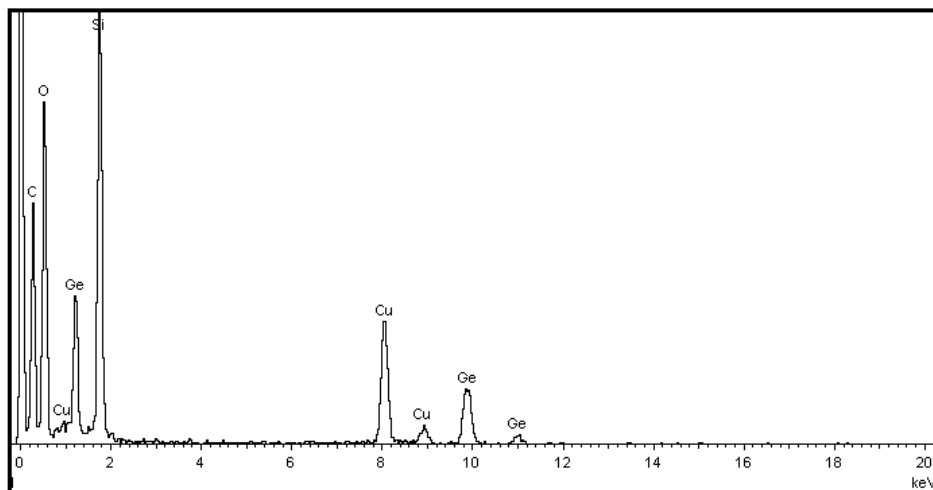


Figure S8. EDS spectrum of nc-Ge/SiO<sub>2</sub>.

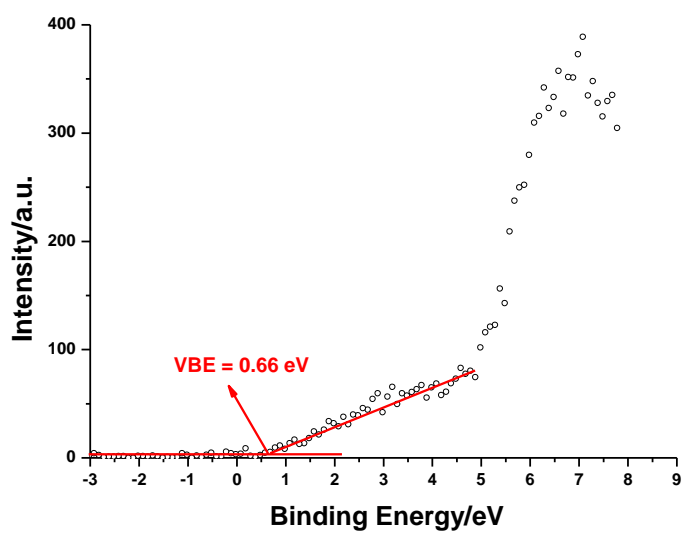


Figure S9. UPS spectrum of nc-Ge.

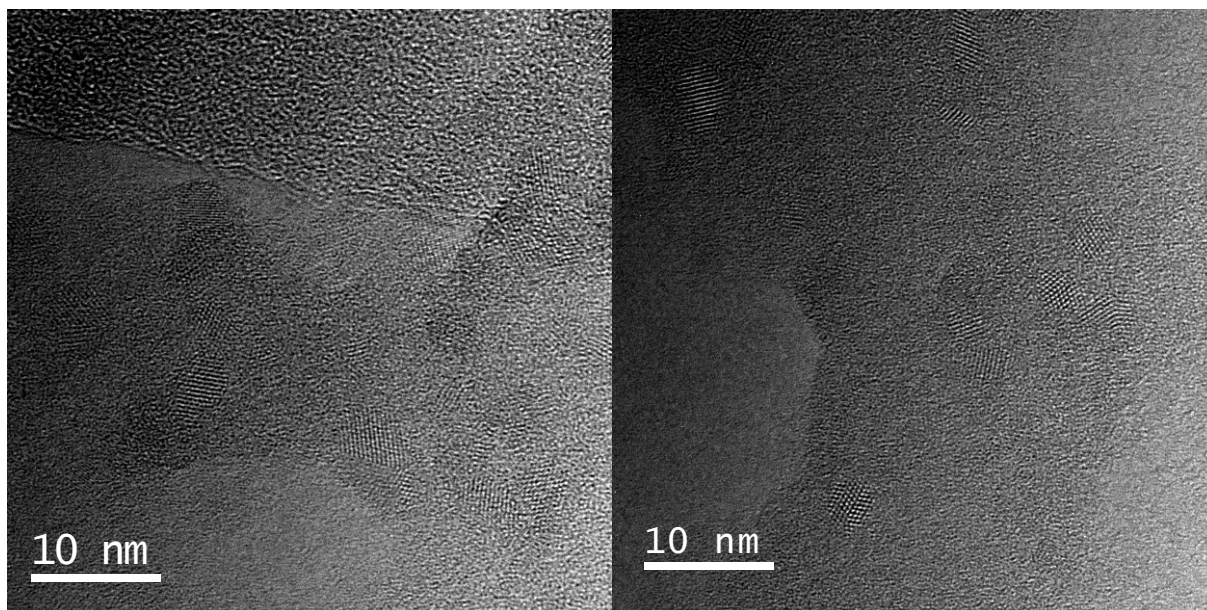


Figure S10. HR-TEM image showing 3-4 nm nc-Ge.

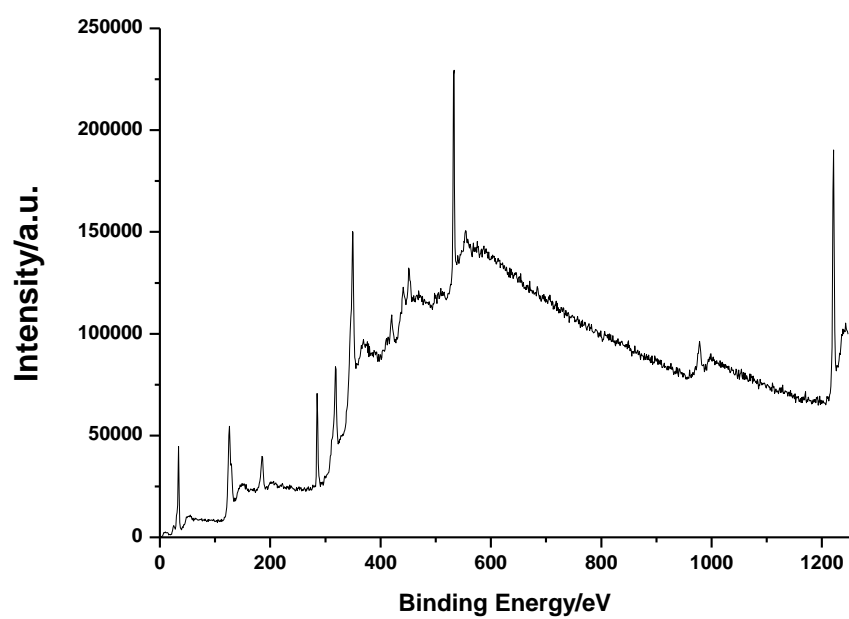


Figure S11. XPS survey scan of nc-Ge after HF etching.