

**Supporting information for: Thermally-Induced
Dehydrogenative Coupling of Organosilanes and
H-terminated Silicon Quantum Dots onto Germanane
Surfaces**

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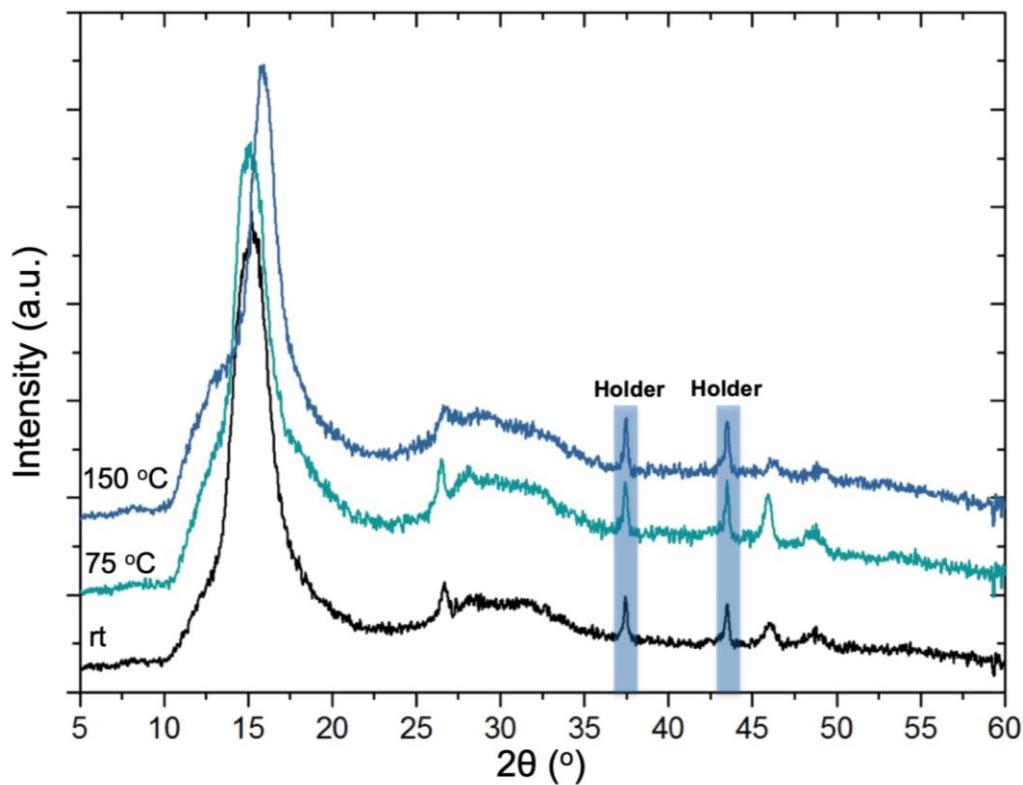


Figure S1. Powder X-ray diffraction of H-Ge flakes after thermal annealing.

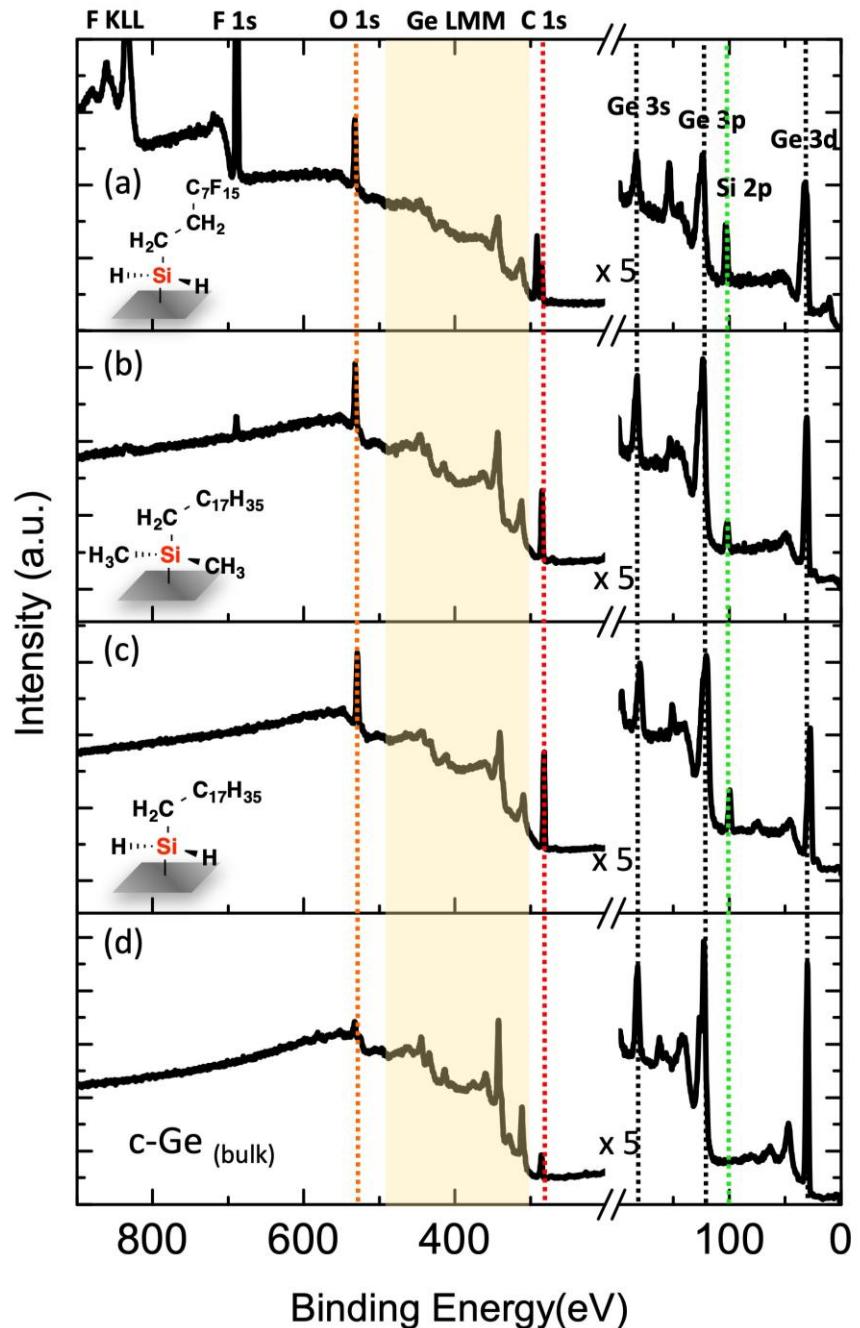


Figure S2. Survey X-ray photoelectron spectra of (a-c) organosilane functionalized GeNSs and (d) clean Ge (111) wafer; the silanes are (a) (tridecafluoro-1,1,2,2- tetrahydrooctyl)silane, (b) dimethyloctadecylsilane and (c) octadecylsilane.

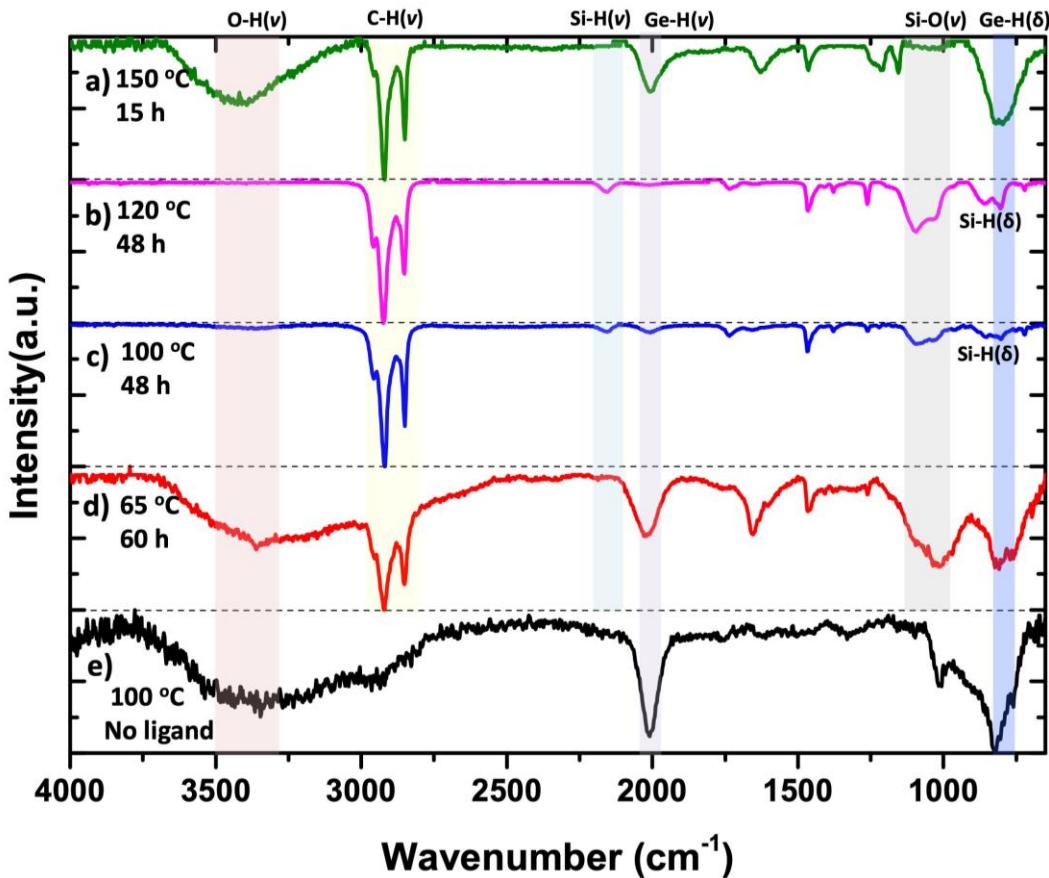


Figure S3. FTIR spectra of products obtained from indicated reaction conditions between octadecylsilane and germanane nanosheets. Products of reactions performed at 100 °C or 120 °C (blue and magenta traces, respectively) show a diminished Ge-H feature (ca. 2000 cm^{-1}) was greatly diminished consistent with effective surface functionalization after 48h. Reaction products obtained from higher reaction temperatures and shorter reaction times (150 °C, 15 hours; green trace) did not provide effective functionalization as evidenced by the presence of features arising from oxygen containing species. Reactions performed at lower temperatures for longer times (i.e., 65 °C, 60 hours; red trace) provide materials exhibiting intense Si-O-Si stretching and Ge-H features consistent with a mixture of oxidized silanes with non-functionalized GeH NSs.

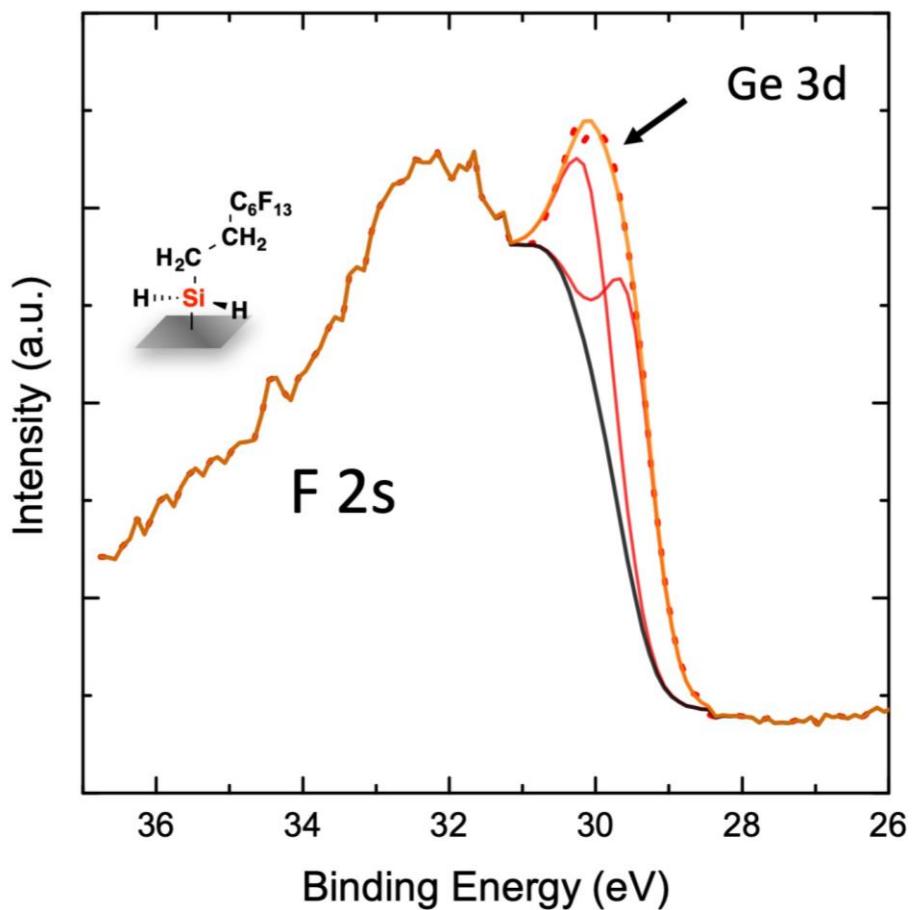


Figure S4. High-resolution XP spectrum of Ge 3d region of (tridecafluoro-1,1,2,2-tetrahydrooctyl) silane-terminated GeNSs. The Ge 3d and F 2s emissions overlap preventing detailed analysis.

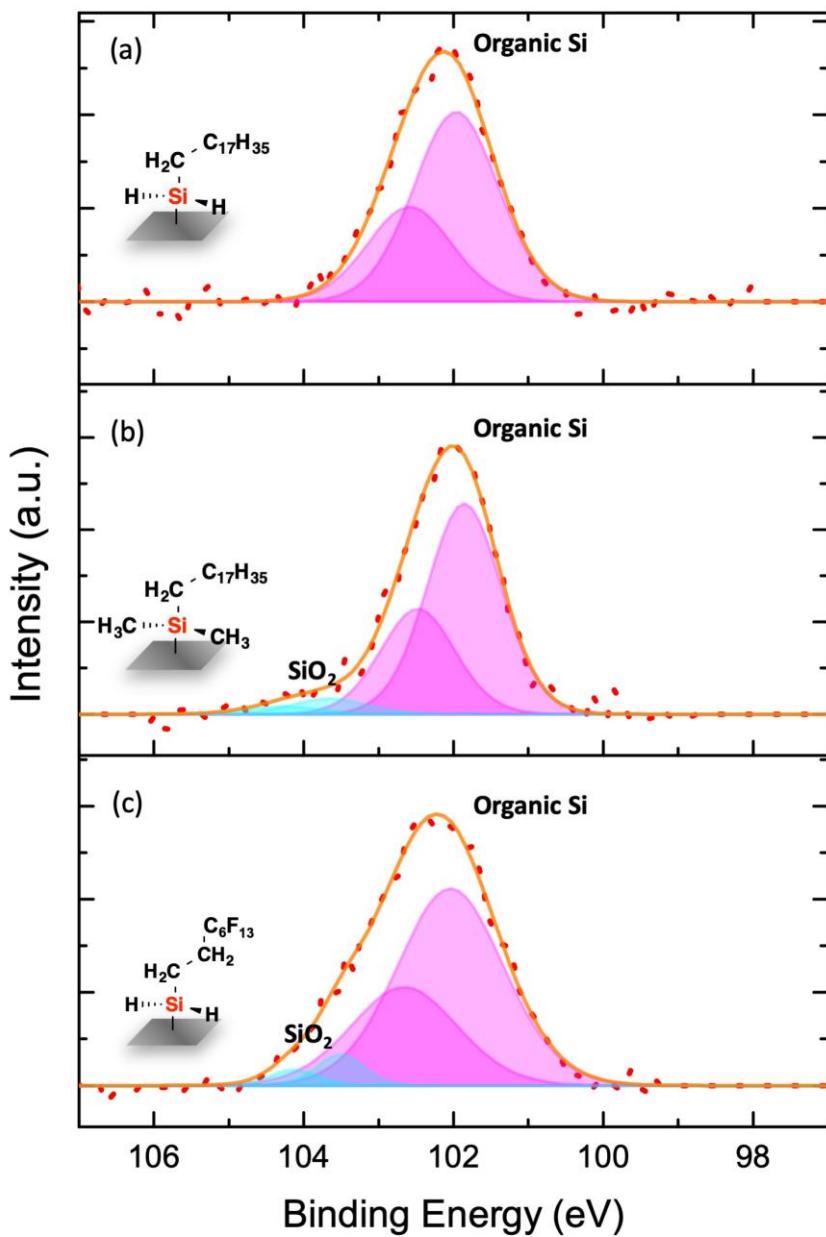


Figure S5. High resolution XP spectra of Si 2p region organosilane functionalized GeNSs, the silanes are (a) octadecylsilane, (b) dimethyloctadecylsilane and (c) (tridecafluoro-1,1,2,2-tetrahydrooctyl) silane.

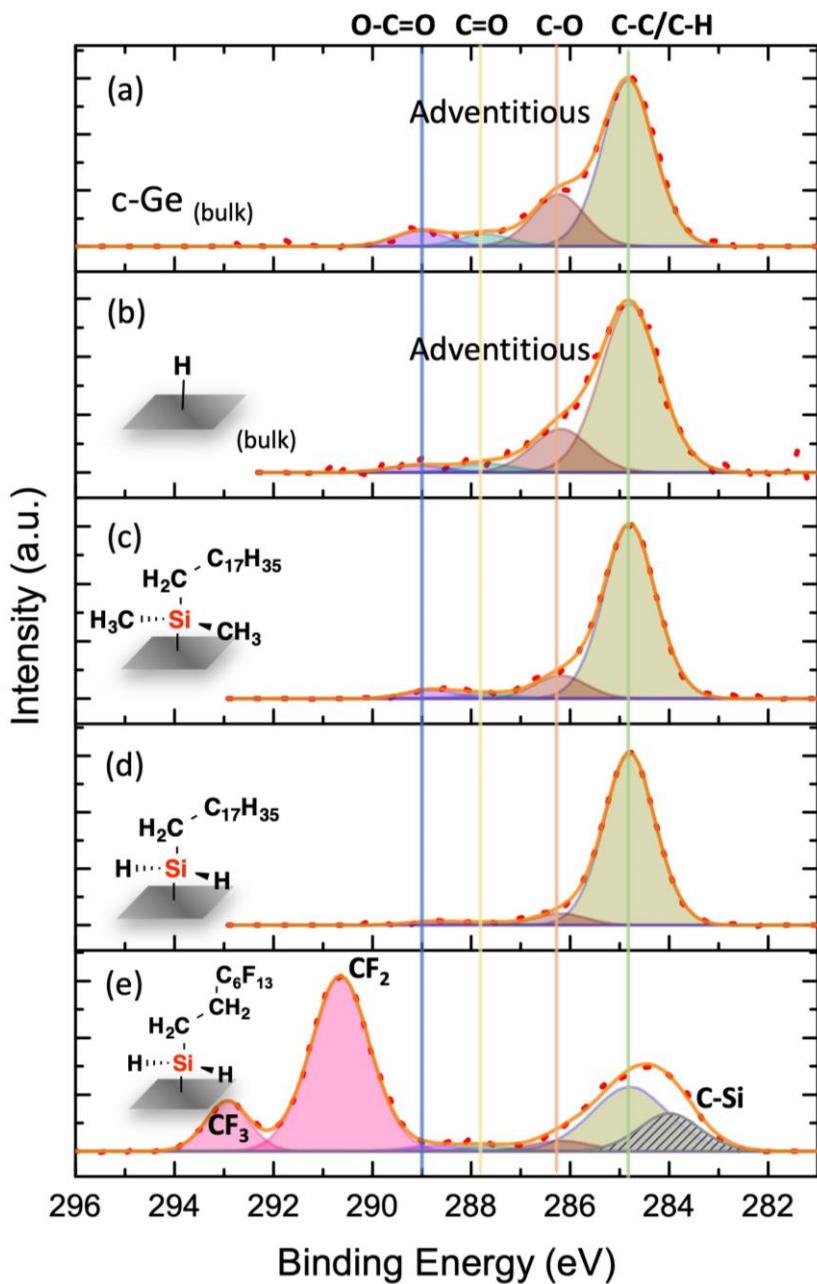


Figure S6. High resolution XP spectra of C1s regions of (a) clean Ge (111) wafer (b) H-Ge flakes, (c-e) organosilane functionalized GeNSs, the silanes are (c) octadecylsilane, (d) dimethyloctadecylsilane and (e) (tridecafluoro-1,1,2,2-tetrahydrooctyl) silane, (a) and (b) were used to evaluate adventitious carbon level.

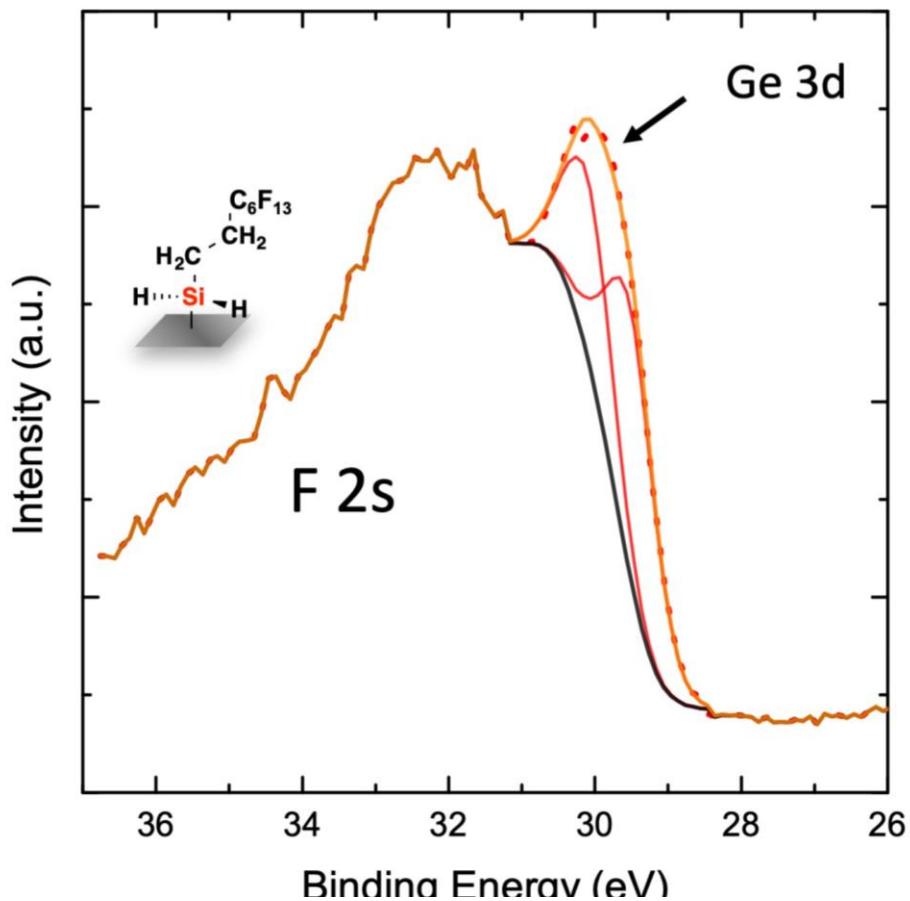


Figure S7. High resolution XP spectrum of F 1s region of (tridecafluoro-1,1,2,2-tetrahydrooctyl) silane-terminated GeNSs

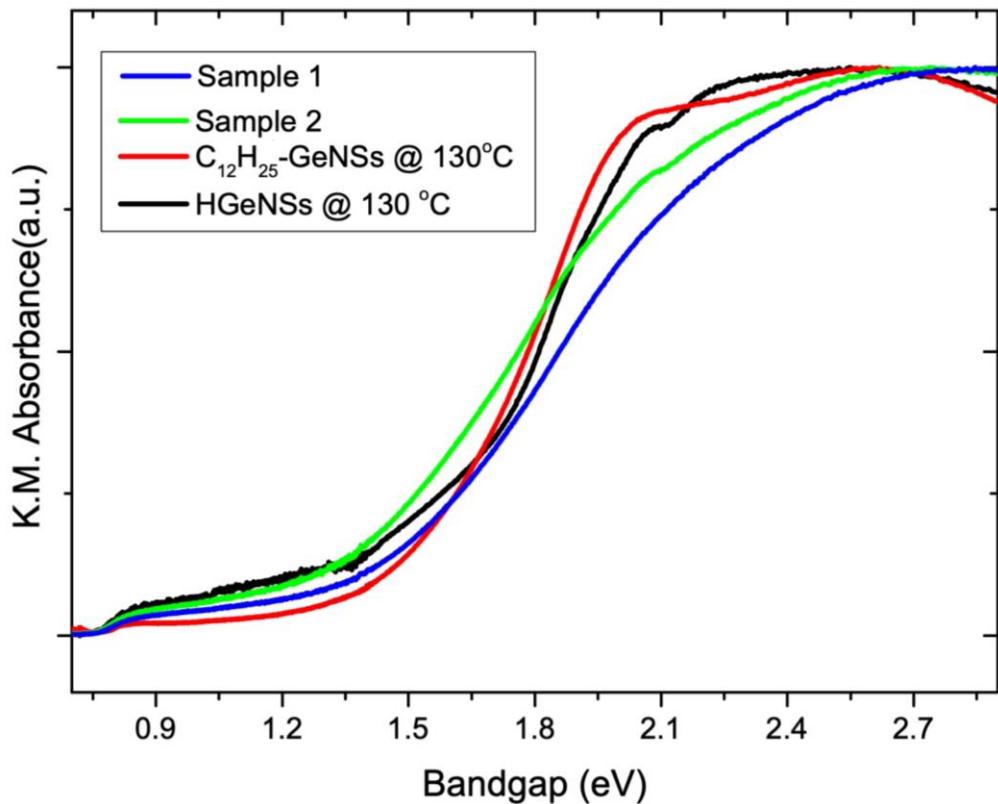


Figure S8. Diffuse reflectance spectra for **(blue)** Sample 1: H-GeNSs reacted with H-SiQDs at 80 °C and dodecyl-functionalized at 130 °C, , **(green)** Sample 2: H-GeNSs reacted with H-SiQDs at 70 °C and dodecyl- functionalized at 130 °C, **(red)** dodecyl- functionalized GeNSs at 130 °C, and **(black)** H-GeNSs heated at 130 °C.

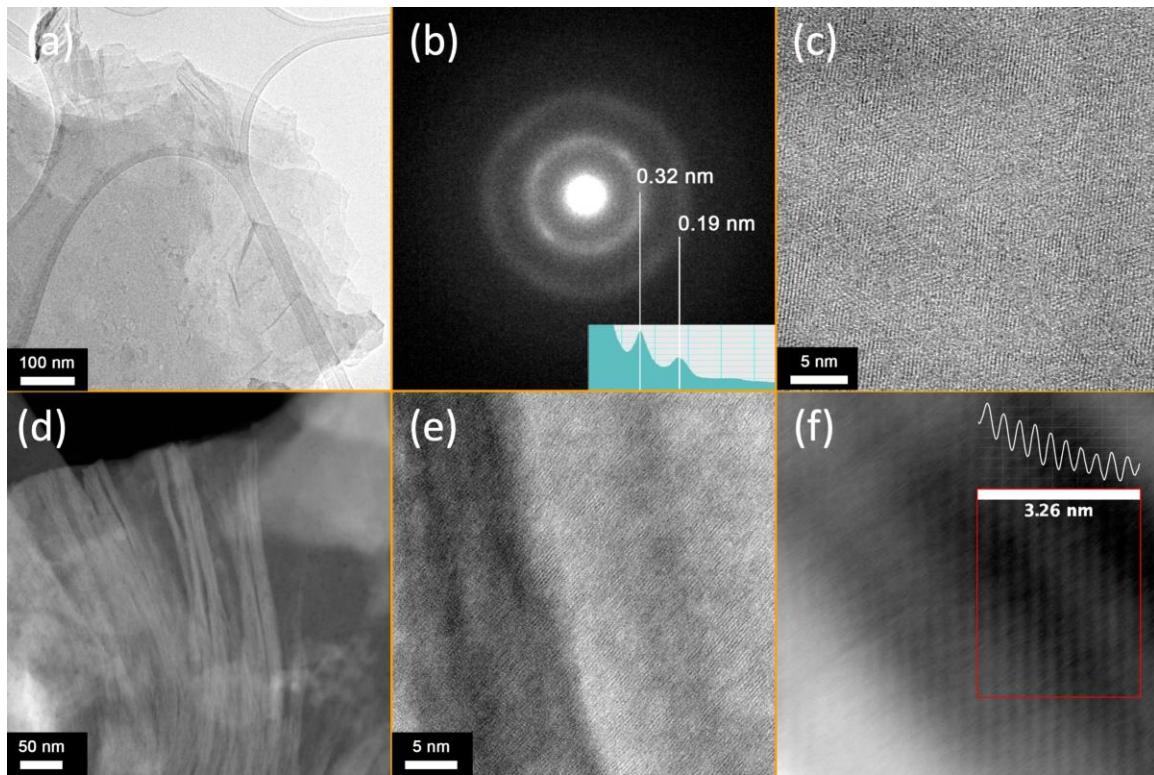


Figure S9. (S)TEM images of trioctylsilane-functionalized GeNSs, (a) bright-field low magnification, (b) SAED pattern at low-magnification (inset: radially integrated signal), (c) higher manginification, and (d-f) dark-field scanning images.

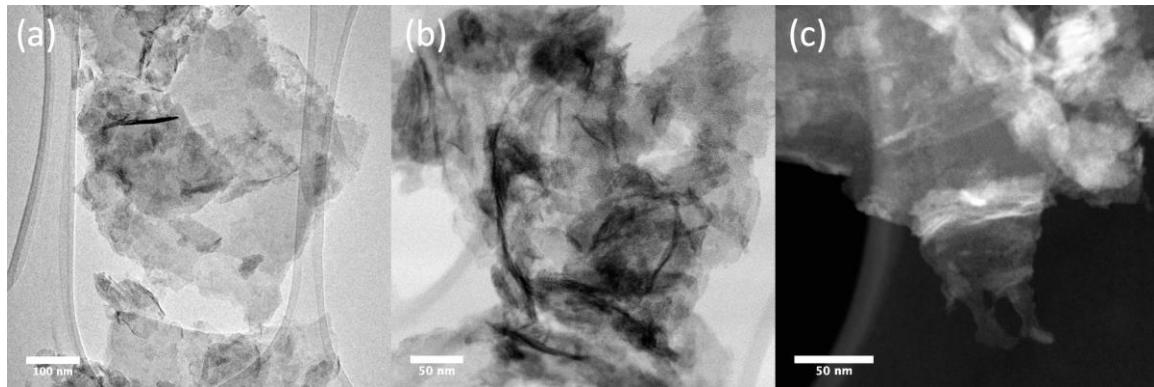


Figure S10. (a, b) bright-field TEM images and (c) dark-field STEM image of (tridecafluoro-1,1,2,2,-tetrahydrooctyl)silane-functionalized GeNSs.

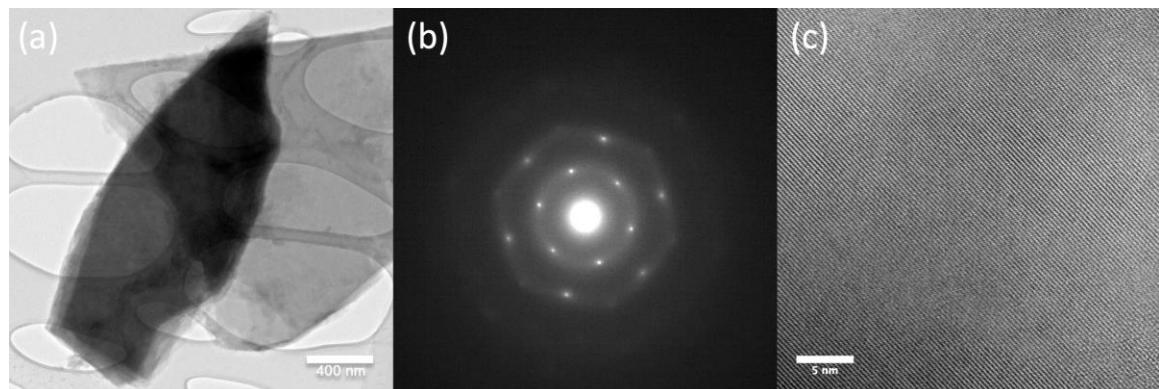


Figure S11. (a) Bright-field TEM image, (b) SAED pattern and (c) high-magnification TEM image of monolayer to few layer H-Ge nanosheets.

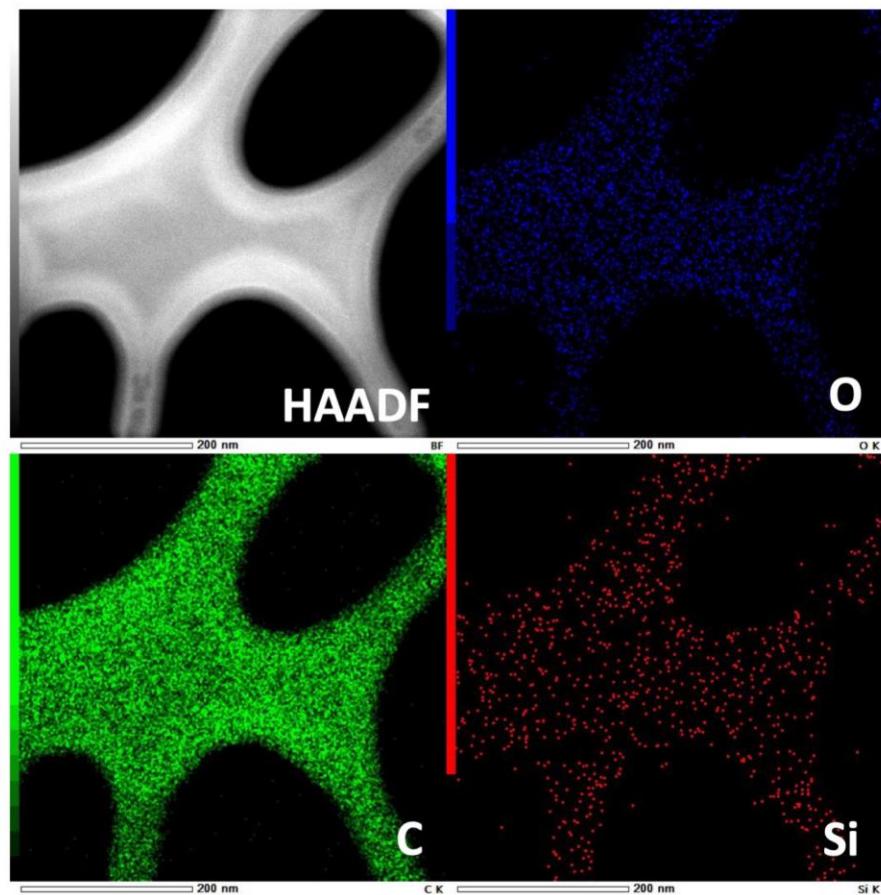


Figure S12. HAADF-STEM with elemental mapping of clean holey carbon grid.

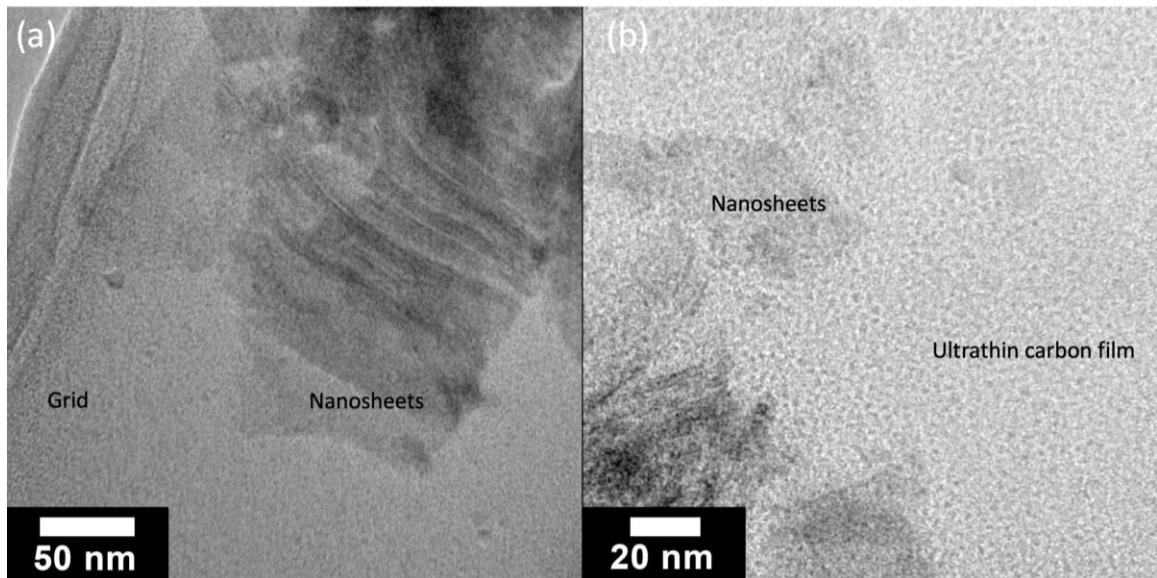


Figure S13. Bright-field TEM images of physical mixture of SiQDs and GeNSs, SiQDs are dark dots observed on GeNSs as well as on (a) support grid and (b) ultrathin carbon film.