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<b>Title</b>	Effects of annealing temperature and ambient on Metal/PtSe <sub>2</sub> contact alloy formation
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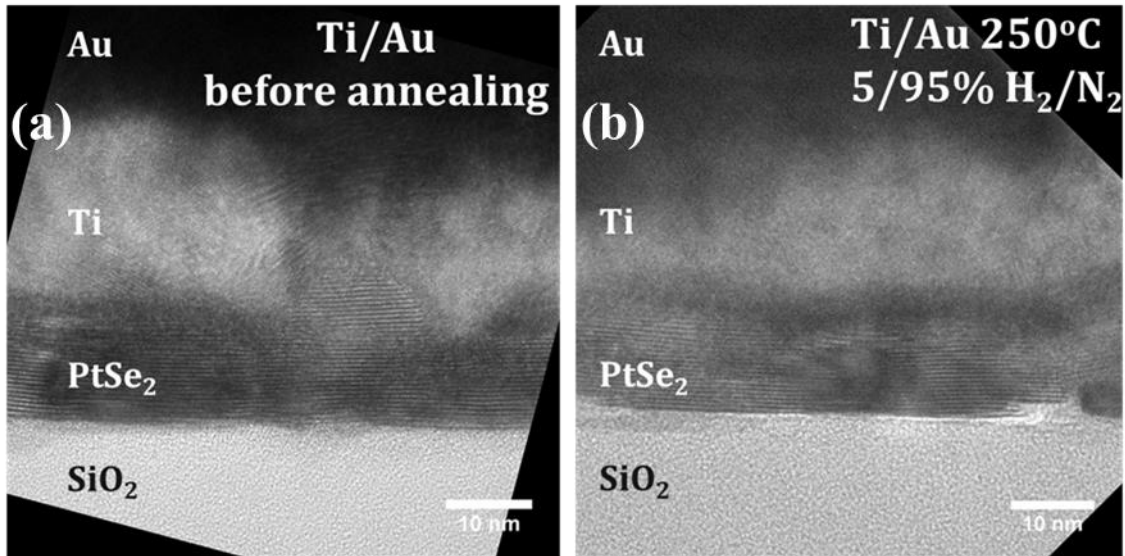
**Supporting Information:**  
**Effects of annealing temperature and ambient**  
**on metal-PtSe<sub>2</sub> contact alloy formation**

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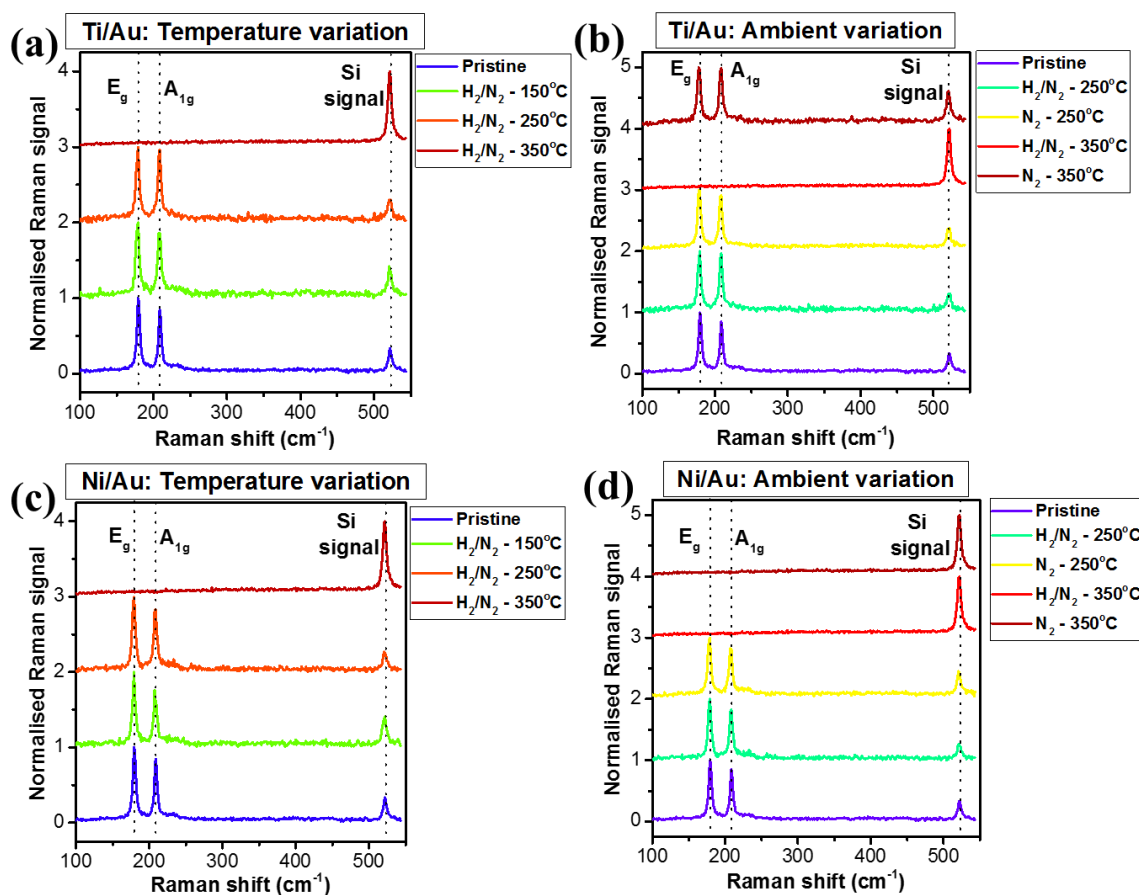
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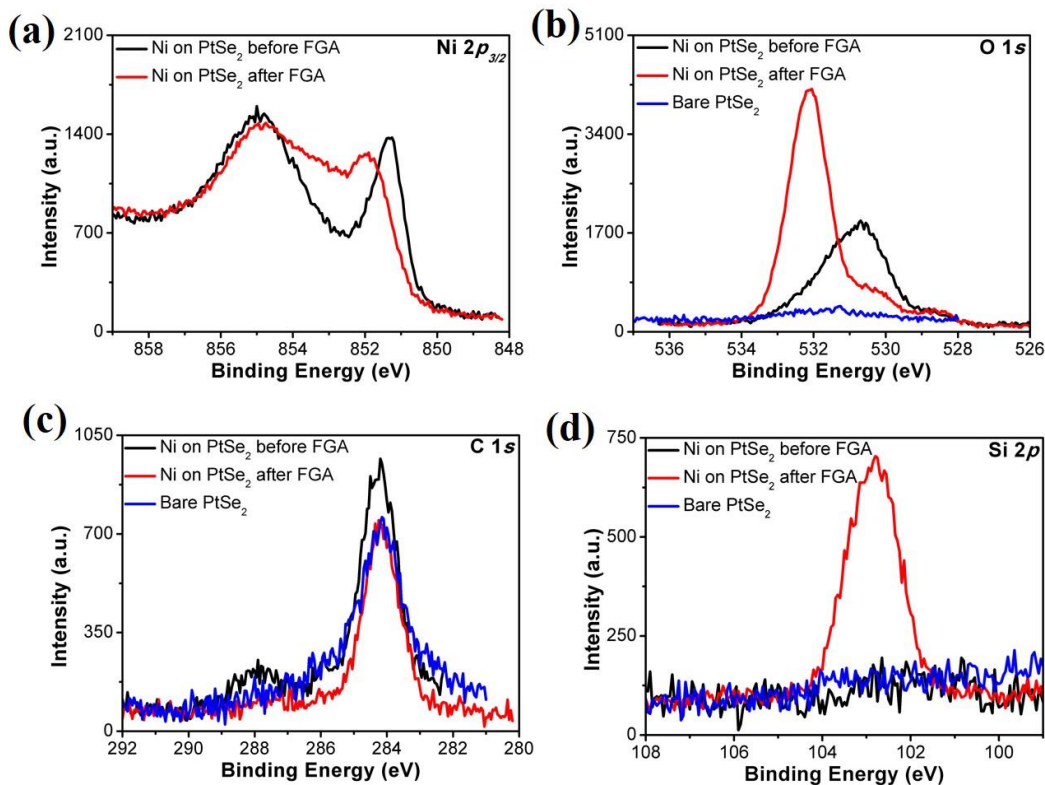
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**Figure S1:** Representative cross-section TEM images of the PtSe<sub>2</sub> contacted with Ti/Au (a) before and (b) after annealing at 250 °C in FG, showing that the layered structure of the PtSe<sub>2</sub> is maintained after annealing.

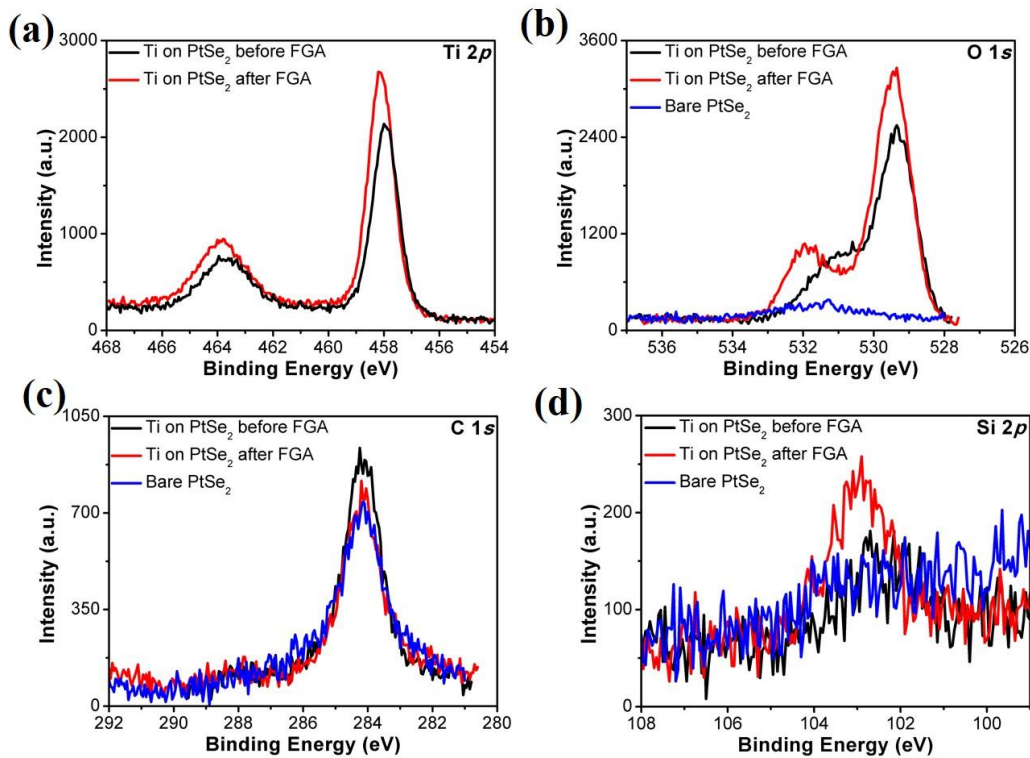


**Figure S2:** Raman signal collected from the PtSe<sub>2</sub> region (not the alloy region) after each annealing variation. (a) and (c) show the Raman signal after annealing in forming gas for each temperature for the Ti/Au and Ni/Au samples respectively. (b) and (d) show the Raman signal after annealing at 250 °C and 350 °C in FG and inert environment for the Ti/Au and Ni/Au samples respectively. When the annealing condition is too harsh the PtSe<sub>2</sub> signal is lost.



**Figure S3:** Additional XPS spectra of as-deposited Ni/PtSe<sub>2</sub> samples. a) Ni 2 $p_{3/2}$ , (b) O 1 $s$ , (c) C 1 $s$ , and (d) Si 2 $p$  spectra.

Figure S2 shows spectra of the as-deposited Ni on PtSe<sub>2</sub> in addition to those included in the main article. The Ni 2 $p_{3/2}$  spectra show a metallic Ni signal at 851.2 eV, and a broad peak centered at ~853 eV. This higher BE peak cannot be directly attributed to the formation of a NiSe<sub>x</sub> due to the number of complex satellite peaks present at higher BE in a Ni 2 $p$  spectra, along with the multiple peak splitting which can occur for Ni compounds. The O 1 $s$  spectra shows an increase in oxidation (compared to bare PtSe<sub>2</sub>) following Ni deposition. This is primarily due to oxidation of the Nickel surface. No significant change in the C 1 $s$  or Si 2 $p$  signal is observed between bare PtSe<sub>2</sub> and Ni on PtSe<sub>2</sub>, indicating no C contamination, or thinning of the PtSe<sub>2</sub> layer (which would lead to an increased Si signal).



**Figure S4:** Additional XPS spectra of as-deposited Ti/PtSe<sub>2</sub> samples. a) Ti 2*p*, (b) O 1*s*, (c) C 1*s*, and (d) Si 2*p* spectra.

Figure S3 shows additional spectra of the as-deposited Ti on PtSe<sub>2</sub>. The Ti 2*p* spectra show a no evidence of a metallic Ti signal rather the peak shape and position are that expected for TiO<sub>2</sub>. This is expected given the very low formation energy of TiO<sub>2</sub>, and the oxygen-gettering nature of Ti. This complete oxidation of the Ti (BE = 529.5 eV) can also be clearly seen in the drastic increase in the O 1*s* signal. No significant change in the C 1*s* or Si 2*p* signal is observed between bare PtSe<sub>2</sub> and Ti on PtSe<sub>2</sub>, again indicating no C contamination, or thinning of the PtSe<sub>2</sub> layer.