

# Neutron irradiation induced displacement damage of indium vacancies on $\alpha$ -In<sub>2</sub>Se<sub>3</sub> nanoflakes

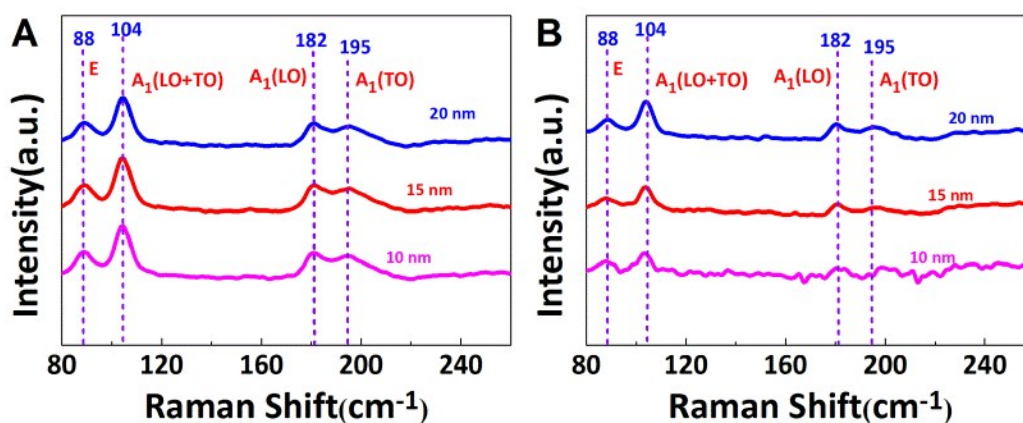
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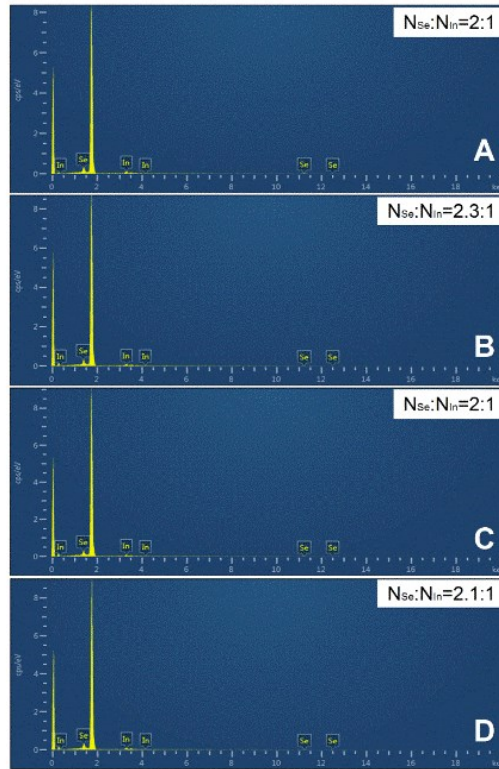
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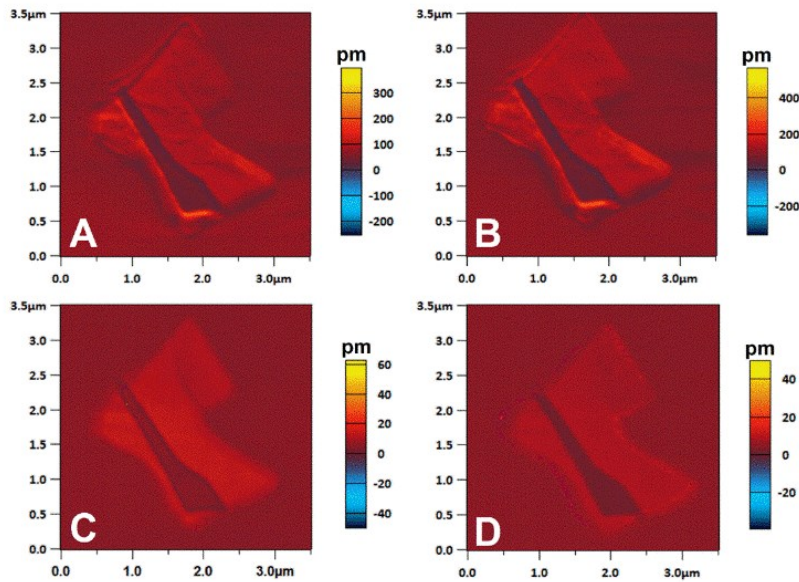


**FIG S1.** Raman spectra image of different thick  $\alpha$ -In<sub>2</sub>Se<sub>3</sub> nanoflakes and substrate with the 532 nm laser excitation. (a) Before neutron irradiation. (b) After neutron irradiation.

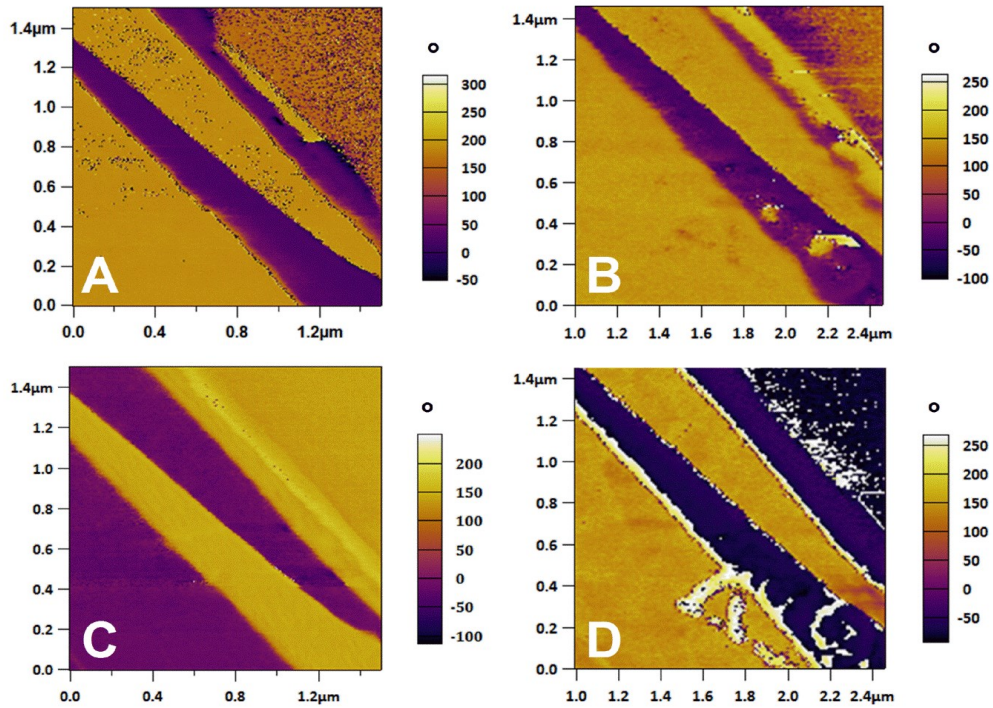
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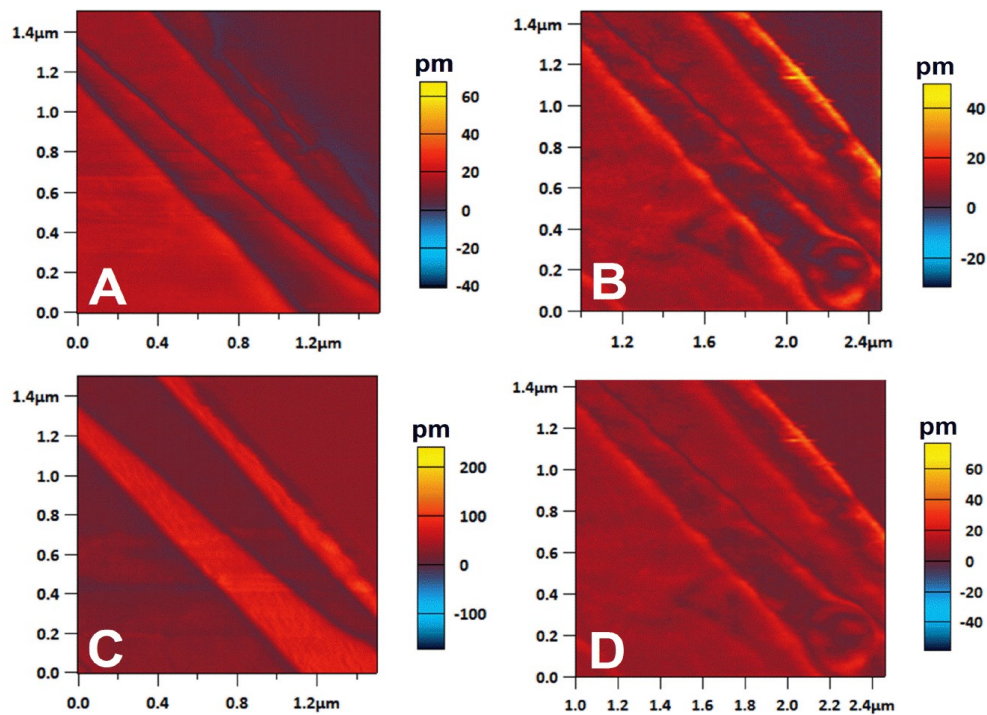
**FIG. S2.** The EDS results of different regions of the  $\alpha$ - $\text{In}_2\text{Se}_3$  nanoflakes after neutron irradiation: (a) 10 nm, (b) 15 nm, (c) 20 nm, (d) 30 nm.



**FIG. S3.** PFM amplitude images of the  $\alpha$ - $\text{In}_2\text{Se}_3$  nanoflakes before (a,c) and after (b,d) neutron irradiation. (a,b) IP phase images. (c,d) OOP phase images.



**FIG S4.** PFM phase images of the  $\alpha$ - $\text{In}_2\text{Se}_3$  nanoflakes (10~15 nm) before (a,c) and after (b,d) neutron irradiation. (a,b) In-plane phase images. (c,d) Out-of-plane phase images.



**FIG S5.** PFM amplitude images of the  $\alpha$ - $\text{In}_2\text{Se}_3$  nanoflakes (10~20 nm) before (a,c) and after (b,d) neutron irradiation. (a,b) In-plane phase images. (c,d) Out-of-plane phase images.