Pressure-induced morphology-dependent phase transformations of nanostructured tin dioxide

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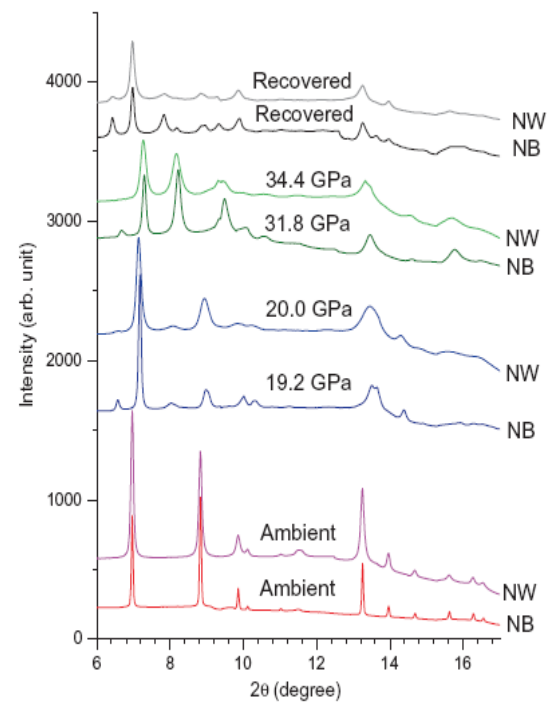
Two morphologies of nanostructured tin dioxide (SnO_2) (i.e., nanobelts and nanowires) were compressed in diamond anvil cells up to 38 GPa followed by decompression. *In situ* Raman spectroscopy and synchrotron X-ray diffraction were employed to monitor the structural transformations. It was found that nanostructured SnO_2 behaved drastically differently than bulk material in terms of transformation pressures, phase stability regions and compressibility. These findings provide new insight into the unique pressure behaviours of nanostructured materials and have profound implications for producing controlled structures with new applications achieved by combined pressure-morphology tuning.

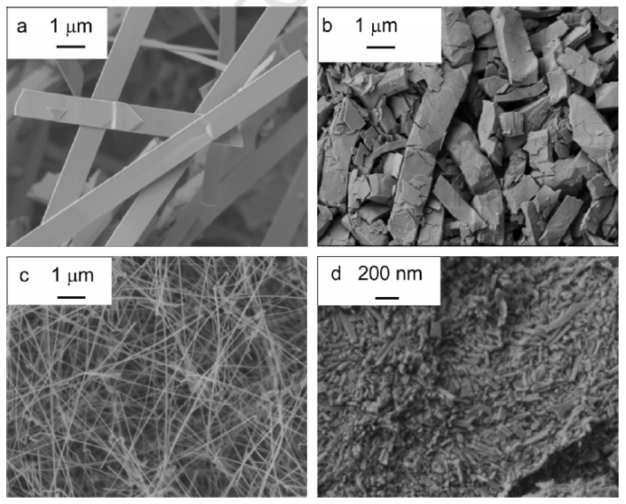
XRD results

Representative X-ray diffraction patterns for SnO_2 nanobelts (labeled as 'NB') in comparison with SnO_2 nanowires (labeled as 'NW') at similar pressures.



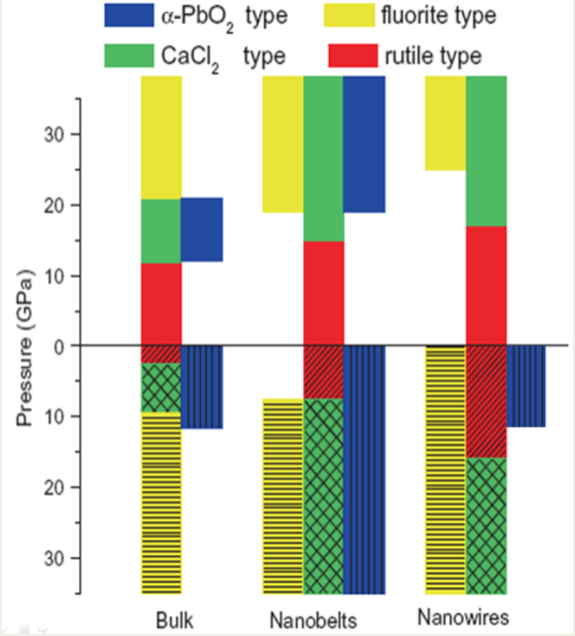
SEM results

The morphologies of SnO_2 nanobelts (a,b) and nanowires (c,d) before (left) and recovered (right) from compression were examined by SEM (Leo/Zesis 1540XB FIB/SEM) in western nanofabrication facility.



Conclusions

Summary of pressure induced phase transformations in SnO_2 nanobelts, nanowires, and bulk upon compression (plain vertical bars) and decompression (hatched vertical bars).



Reference

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