

31. Spevack, P. A. & McIntyre, N. S. Thermal reduction of  $\text{MoO}_3$ . *J. Phys. Chem.* **96**, 9029–9035 (1992).
32. Blanco, E., Sohn, H. Y., Han, G. & Hakobyan, K. Y. The kinetics of oxidation of molybdenite concentrate by water vapor. *Metall. Mater. Trans. B* **38**, 689–693 (2007).
33. Walter, T. N., Kwok, F., Simchi, H., Aldosari, H. M. & Mohny, S. E. Oxidation and oxidative vapor-phase etching of few-layer  $\text{MoS}_2$ . *J. Vac. Sci. Technol. B* **35**, 021203 (2017).
34. Blackburn, P. E., Hoch, M. & Johnston, H. L. The vaporization of molybdenum and tungsten oxides. *J. Phys. Chem.* **62**, 769–773 (1958).
35. Kadiev, K. M., Gyul'maliev, A. M., Shpirt, M. Y. & Khadzhiev, S. N. Thermodynamic and quantum chemical study of the transformations and operation mechanism of molybdenum catalysts under hydrogenation conditions. *Petrol. Chem.* **50**, 312–318 (2010).
36. Frey, G. L. *et al.* Investigations of nonstoichiometric tungsten oxide nanoparticles. *J. Solid State Chem.* **162**, 300–314 (2001).
37. Chen, J. *et al.* Synthesis and Raman spectroscopic study of  $\text{W}_{20}\text{O}_{58}$  nanowires. *J. Phys. D* **41**, 115305 (2008).
38. Lu, D. Y., Chen, J., Deng, S. Z., Xu, N. S. & Zhang, W. H. The most powerful tool for the structural analysis of tungsten suboxide nanowires: Raman spectroscopy. *J. Mater. Res.* **23**, 402–408 (2008).
39. Rothschild, A., Frey, G. L., Homyonfer, M., Tenne, R. & Rappaport, M. Synthesis of bulk  $\text{WS}_2$  nanotube phases. *Mater. Res. Innov.* **3**, 145–149 (1999).
40. Smolik, G. R., Petti, D. A., McCarthy, K. A. & Schuetz, S. T. *Oxidation, Volatilization, and Redistribution of Molybdenum from TZM Alloy in Air*. Report No. INEEL/EXT-99-01353 (Idaho National Engineering and Environmental Laboratory, 2000).
41. Taskinen, P., Hytonen, P. & Tikkanen, M. H. On the reduction of tungsten oxides. II. *Scand. J. Metall.* **6**, 228–232 (1977).
42. Sarin, V. K. Morphological changes occurring during reduction of  $\text{WO}_3$ . *J. Mater. Sci.* **10**, 593–598 (1975).
43. Lalik, E., David, W. I. F., Barnes, P. & Turner, J. F. C. Mechanisms of reduction of  $\text{MoO}_3$  to  $\text{MoO}_2$  reconciled? *J. Phys. Chem. B* **105**, 9153–9156 (2001).
44. Jadcak, J. *et al.* Composition dependent lattice dynamics in  $\text{MoS}_x\text{Se}_{(2-x)}$  alloys. *J. Appl. Phys.* **116**, 193505 (2014).
45. Feng, Q. *et al.* Growth of  $\text{MoS}_{2(1-x)}\text{Se}_{2x}$  ( $x = 0.41\text{--}1.00$ ) monolayer alloys with controlled morphology by physical vapor deposition. *ACS Nano* **9**, 7450–7455 (2015).