Supplementary Information

Ultra-narrow WS_2 Nanoribbons Encapsulated in Carbon Nanotubes

Zhiyong Wang,†[a] Keke Zhao,†[ad] Hong Li,†[b] Zheng Liu,[c] Zujin Shi,*[a] Jing Lu,*[b] Kazu Suenaga,*[c] Soon-Kil Joung,[c] Toshiya Okazaki,[c] Zhaoxia Jin,[d] Zhennan Gu,[a] Zhengxiang Gao,[b] and Sumio Iijima[c]

[a]*Beijing National Laboratory for Molecular Sciences, State Key Lab of Rare Earth Materials Chemistry and Applications, College of Chemistry and Molecular Engineering, Peking University, Beijing 100871, P. R. China. Fax: 86-10-62751708; Tel: 86-10-62751495; E-mail: zjshi@pku.edu.cn*

[b]*State Key Laboratory of Mesoscopic Physics and Department of Physics, Peking University, Beijing 100871, P. R. China. Fax: 86-10-62751615; Tel: 86-10-62756393; E-mail: jinglu@pku.edu.cn*

[c]*Nanotube Research Center, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba 305-8565, Japan. Fax: 81-29-861-4806; Tel: 81-29-861-6850; E-mail: suenaga-kazu@aist.go.jp*

[d]*Department of Chemistry, Renmin University of China, Beijing 100872, P. R. China*

† These authors contributed equally to this work.

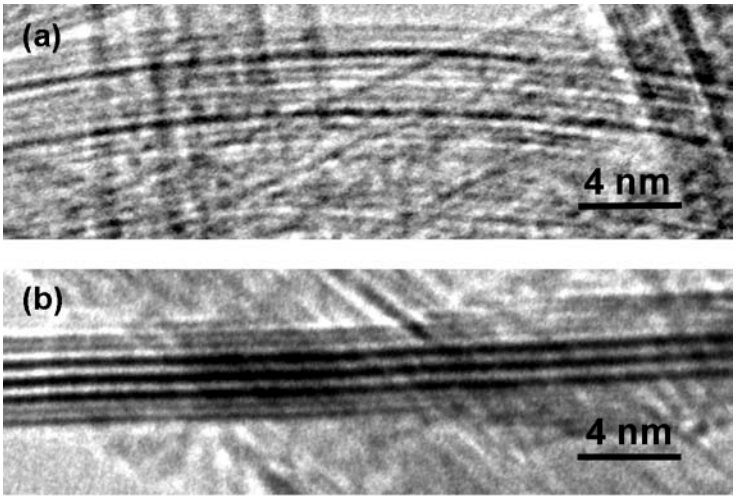

Fig. S1 HR-TEM (Hitachi H-9000NAR, 100 kV) image of (a) single-layer WS_2NR and (b) triple-layer WS_2NR encapsulated in DWCNT.

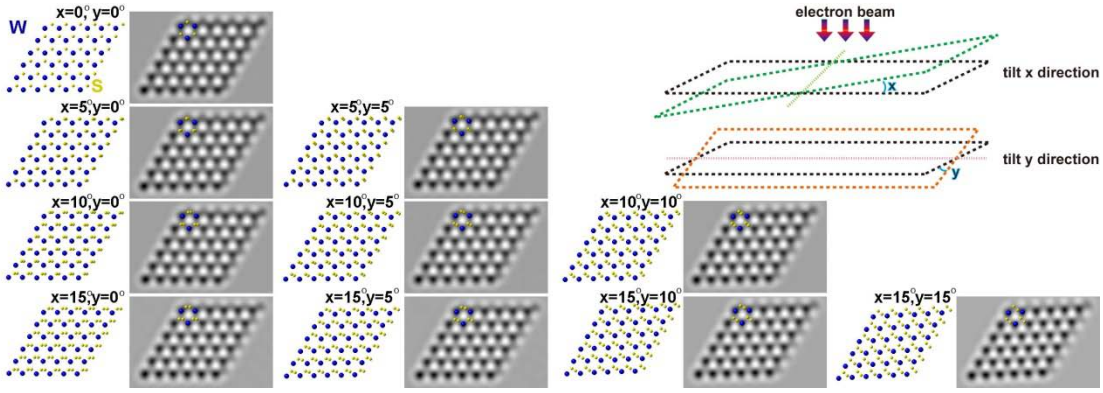

Fig. S2 HR-TEM simulation and structural model of a single-layer WS_2NR at 10 different tilting angles.

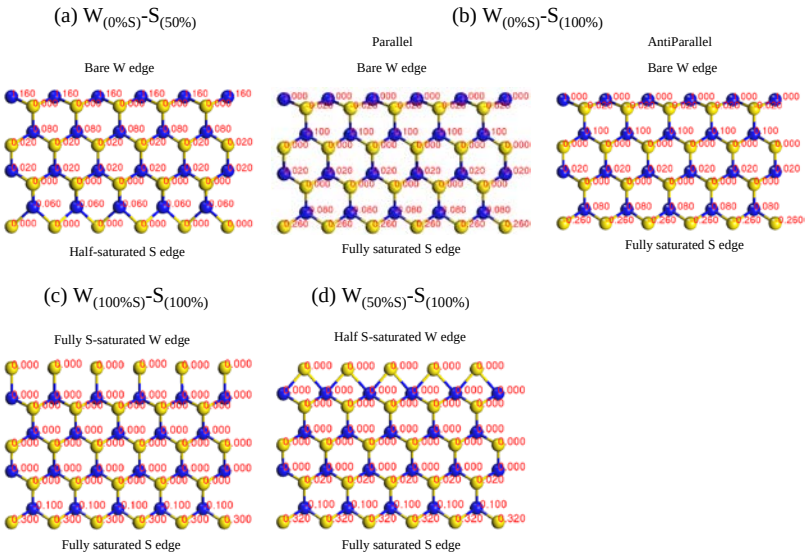

Fig. S3 Ground-state magnetic moments on the atoms arranged by descending δG of the 4-ZWS_2NRs. The nonmagnetic 4-ZWS_2NRs with $W_{(100\%S)}$-$S_{(50\%)}$ and $W_{(50\%S)}$-$S_{(50\%)}$ edge configurations are not shown here. The parallel and antiparallel spin orientations between the two edges in (b) are degenerate in total energy. Blue ball: W; yellow ball: S.