

Controlled Growth and Applications of Nanoscale Materials

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Nanoscale materials have attracted great interests in recent years. One-dimensional and two-dimensional nanostructures such as nanowires, nanorods, nanowalls, nanosheets, and nanojunctions or networks are an important category of nanostructured materials with great potential as important components for nanoscale devices with various interesting functions. Thus, in the past decade, many techniques have been developed for the synthesis of such nanostructured materials. Some examples of these techniques include chemical vapor deposition, vapor-liquid-solid growth, vapor-solid growth, oxide-assisted growth, carbothermal synthesis, hydrothermal growth and etc. With these methods, one can synthesize a wide variety of nanostructured materials including binary and ternary II-VI alloys, hierarchical metal oxide and etc. In addition to the above mentioned techniques, a wide variety of nanoscale metal oxide materials with fascinating morphologies can be synthesized by heating pure metallic foils or wires in appropriately controlled atmospheres. Many of these nanoscale material exhibits unique properties rendering them potentially attractive materials for possible applications. In this report, we will present our recent efforts in the growth and characterizations of these nanoscale materials with emphasis of the growth mechanism and potential applications of these nanoscale materials.

References:

- [1] "Reduced Graphene Oxide Conjugated Cu₂O Nanowire Mesocrystals for High-Performance NO₂ Gas Sensor" **J. Am. Chem. Soc.** **2012**, 134, 4905-4917, Deng, S; Tjoa, V; Fan, HM; Tan, HR; Sayle, D. C.; Olivo, M.; M., Subodh; Wei, J.; Sow, CH
- [2] "K-Enriched MoO₃ Nanobundles: A Layered Structure with High Electric Conductivity" **J. Phys. Chem. C**, **2012**, 116, 3962-3967, Hu, Z.; Zhou, C.; Zheng, M.; Lu, J.; Varghese, B.; Cheng, H.; Sow, CH
- [3] "Optical and electrical applications of ZnS_xSe_{1-x} nanowires-network with uniform and controllable stoichiometry", **Nanoscale**, **2012**, 4, 976-981, Lu, J.; Liu, H.; Sun, C.; Zheng, M.; Nripan, M.; Chen, G.S.; Subodh, G. M.; Zhang, X.; Sow, CH

- [4] "Facile One-Step Synthesis of CdS(x)Se(1-x) Nanobelts with Uniform and Controllable Stoichiometry", **J. Phys. Chem. C**, **2011**, 115, 19538-19545, J., Lu; C., Sun; M., Zheng; M., Nripan; H., Liu; GS, Chen; X., Zhang; M.G., Subodh; CH Sow
- [5] "Photothermoelectric Effects in Localized Photocurrent of Individual VO(2) Nanowires" **J. Phys. Chem. C**, **2010**, 114, 15149-15156, Varghese, B., Tamang, R., Tok, ES, M.G., Subodh G, Sow, CH
- [6] "Structure-Mechanical Property of Individual Cobalt Oxide Nanowires", **Nano Lett.** **2008**, 8, 3226-3232, Varghese, B., Zhang, YS, Dai, L., Tan, V. B. C. Lim, CT, Sow, CH
- [7] "Nb2O5 nanowires as efficient electron field emitters", **J. Phys. Chem. C** **2008**, 112, 10008-10012, Varghese, B., Sow CH, Lim CT
- [8] "WO3-x nanorods synthesized on a thermal hot plate", **J. Phys. Chem. C**, **2007**, 111, 17193-17199, Cheong, Fook Chiong , Varghese, B., Zhu, YW, Tan, E.P.S., Dai, L., Tan, V. B. C. , Lim, C.T., Sow, CH
- [9] "alpha-Fe2O3 nanoflakes as an anode material for Li-ion batteries", **Adv. Funct. Mater.** **2007**, 17, 2792-2799, Reddy, M. V. , Yu, T., Sow, CH, Shen, ZX, Lim, CT, Rao, G. V. S., Chowdari, B. V. R.
- [10] "Co3O4 nanostructures with different morphologies and their field-emission properties", **Adv. Funct. Mater.** **2007**, 17, 1932-1939, Varghese, B., Teo, CH, Zhu YW, Reddy, MV, Chowdari, B.V.R., Wee, ATS, V., Tan B. C. , Lim, CT, Sow, CH
- [11] "Co-synthesis of ZnO-CuO nanostructures by directly heating brass in air", **Adv. Funct. Mater.** **2006**, 16, 2415-2422, Zhu, Y, Sow, CH, Yu, T, Zhao, Q, Li, P., Shen, ZX, Yu, D., Thong, J.T.L
- [12] "Controlled growth and field-emission properties of cobalt oxide nanowalls" **Adv. Mater.** **2005**, 17, 1595, Yu T, Zhu YW, Xu XJ, Shen ZX, Chen P, Lim CT, Thong JTL, Sow CH.