



Nanorod Niobium Oxides as Powerful Catalysts for an All Vanadium Redox Flow Battery

1 Bin Li, et al. *Nano Letters* 3(2014) 1330.

BIN LI, ZIMIN NIE, BRENT KIRBY, EDWIN THOMSEN, DAVID REED, WEI WANG, VINCENT SPRENKLE

Challenges for VRB: High cost

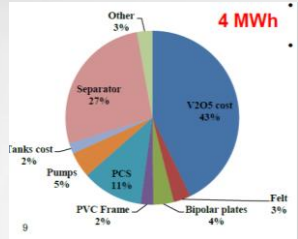
Reducing stack size

Increasing charge/discharge current density

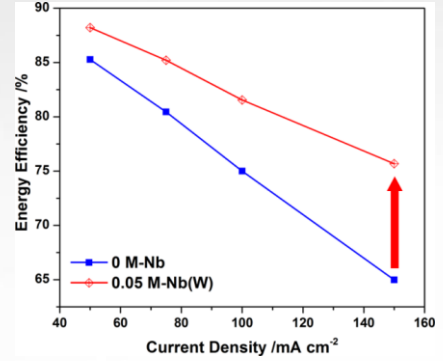
Energy efficiency

Utilization ratio of fuels

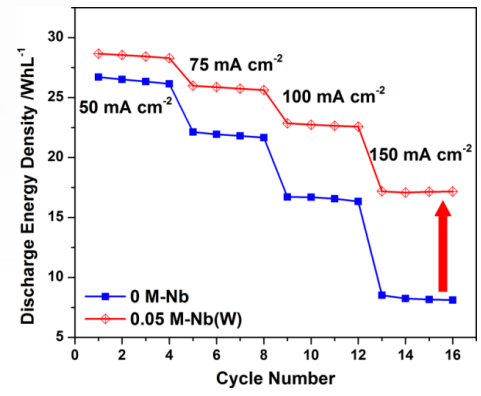
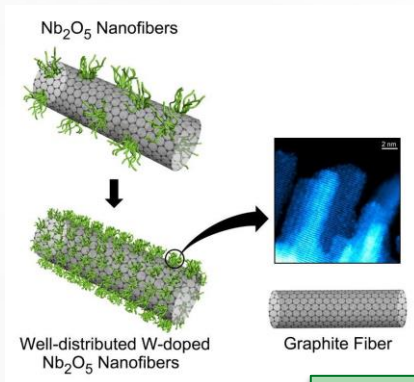
Optimization of carbon electrodes



Viswanathan, Vilayanur, et al. *JPS*(2012).



~11% increase in efficiency



~25% increase in vanadium utilization

Pacific Northwest National Laboratory
Richland, WA 99352