Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Deformations and nanomechanical energy storage in twisted carbon nanotube ropes[1] DAVID TOMANEK, ZACHARIAS G. FTHENAKIS, Michigan State University, GOTTHARD SEIFERT, DAVID TEICH, TU Dresden — We determine the deformation energetics and energy density of twisted carbon nanotube ropes that effectively constitute a torsional spring. Due to the unprecedented stiffness and resilience of constituent carbon nanotubes, a twisted nanotube rope becomes an efficient energy carrier. Using *ab initio* and parameterized density functional calculations, we identify structural changes in these systems and determine their elastic limits. The deformation energy of twisted nanotube ropes contains contributions associated not only with twisting, but also with stretching, bending and compression of individual nanotubes. We quantify these energy contributions and show that their relative role changes with the number of nanotubes in the rope. The calculated reversible nanomechanical energy storage capacity of carbon nanotube ropes surpasses that of advanced Li-ion batteries by up to a factor of ten.

[1]Supported by the National Science Foundation Cooperative Agreement #EEC-0832785, titled "NSEC: Center for High-rate Nanomanufacturing".

David Tomanek
Michigan State University

Date submitted: 19 Dec 2012 Electronic form version 1.4