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Curvature-induced Effects on the Phonon Modes in Sub-nanometer Diameter Single-walled Carbon Nanotubes RAMAKRISHNA PODILA, Clemson University, RAHUL RAO, Air Force Research Laboratory, Materials and Manufacturing Directorate, WPAFB, OH, CODRUTA LOEBICK, NAN LI, Yale University, JASON REPPERT, Clemson University, LISA PFEFFERLE, Yale University, APPARAO M. RAO, Clemson Univeristy — Sub-nanometer diameter single-walled carbon nanotubes (sub-nm SWNTs) are of great interest for fundamental studies due to the effect of large curvature on their properties. We have recently synthesized high quality, narrow diameter distribution sub-SWNTs using CoMn catalysts supported on MCM-41 silica templates in a thermal chemical vapor deposition process [1]. The high curvature in the sub-nm SWNTs leads an unusual S-like dispersion of the G-band frequency due to the strong electron–phonon coupling. In addition, we observe diameter-selective intermediate frequency modes (IFMs) that are as intense as the low frequency radial breathing modes (RBMs). The effect of large curvature in the sub-nm SWNTs is also evident in the lower phonon dispersion of the double resonant Raman features compared to SWNTs with larger diameters. The origin of previously unidentified IFM features (600-1100 cm^{-1}) and the dispersion of high frequency phonons (1650 – 2300 cm^{-1}) will be discussed.
[1] C. Z. Loebick *etal.*, *J. Am. Chem. Soc.*,132, 11125 (2010)

Ramakrishna Podila
Clemson University

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