330c Solving the Matrix Dispersion Problem for Single Walled Carbon Nanotube Composites

Rachel A. Graff, Rachel Leong, and Michael S. Strano

The lack of matrix dispersion is frequently cited as one principle reason why single walled carbon nanotube (SWNT) have not yielded the enormously large enhancement of mechanical properties predicted from theory. Single carbon nanotubes and their aggregates posses elastic and shear moduli near 1 TPa and 1 GPa respectively. An Eshelby-Mori-Tanaka model for inclusions predicts more than a 20 fold increase in matrix modulus at 10% vol. frac. loading for 1-D aligned SWNT. In practice, actual nanocomposites have demonstrated performance far below these predictions. It has been shown that one reason for the mismatch between theory and experiment is inter-bundle translation and extension. This presentation will outline non-destructive methods for gauging matrix dispersion and report the first materials and processes that exhibit individual nanotube dispersion in a matrix at relatively high loading. These examples provide proof of principle that such dispersion is possible and point to routes for realizing it for practical materials.