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A Novel Multidirectional, Non-Contact Strain-Sensing Nanocomposite PAUL WITHEY, Dept. of Physics, University of Houston - Clear Lake, SRIVISHNU VEMURU, SERGEI BACHILO, SATISH NAGARAJAIAH, R. BRUCE WEISMAN, R.E. Smalley Institute for Nanoscale Science and Technology, Rice University — Single-walled carbon nanotubes (SWCNTs) have been successfully dispersed in a polymeric host resulting in the development of a novel strain-sensitive nanocomposite material with promise for scalability. Dubbed "strain paint" this new material when coated onto a surface becomes a smart-skin sensor that can detect strain through load transfer from the polymeric host to embedded SWCNTs. Strain is easily measured in a non-contact manner via laser excitation and detection of the unique near-infrared (NIR) fluorescence spectrum of semiconducting SWCNTs. When strained, each (n, m) SWCNT type exhibits a predictable shift in its NIR fluorescence peak. SWCNTs with high intensity are easily detected in the bulk fluorescence spectrum of raw, unsorted SWCNTs embedded in the polymer. Thin films of the polymer/SWCNT nanocomposite were spin-coated onto substrates, strains typically up to 1% were applied, and strain magnitudes were determined by resistive strain gauges bonded to the coating and substrate. Spectral shifts reveal a linear response to strain with little hysteresis. Two SWCNT types exhibiting opposite spectral shifts with strain were used to improve sensitivity. Strain along any direction is determined simply by adjusting the polarization of the excitation laser.

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