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Forming Carbon-Nanotube Clusters Using Dielectrophoresis for Respiratory Sensing Applications

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In this paper, we present the development of a carbon-nanotube (CNT) resistive respiratory sensor for detecting and monitoring human breath. The sensing element of the device is realized by forming a cluster of multi-walled CNTs (MWCNTs) on two planar gold-sensing electrodes using the dielectrophoresis (DEP) technique. A DEP electrode probe was proposed for creating the CNT cluster. The electrode pair on a silicon substrate was patterned using a standard lift-off technique. An air-controlled polymethylmethacrylate (PMMA) heating chamber was designed and implemented to accelerate the DEP process as well as achieve a uniformly shaped CNT cluster. While the respiratory gas flows across the MWCNT cluster, the vapor molecules condensing on the junctions between neighboring MWCNTs cause variations in the resistance of the MWCNT cluster. Preliminary measurement results show that the proposed sensor has an excellent sensitivity and a rapid response with a high signal-to-noise ratio, and is suitable for detecting and monitoring human breath under various conditions.

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