# BuckyPaper: Investigating the Viability of Multi-Walled Carbon Nanotubes in Sensors for the Detection of Various Gases

Shar, Andy (School: Vanguard High School)

Current gas sensors possess many disadvantages, from low gas specificity to short life spans to the requiring of extensive maintenance. Carbon nanotubes' extremely specific structure inspired this scientist to investigate their possibility to form the main components of gas sensors. Single-walled carbon nanotubes (SWCNT) are more expensive than their multi-walled counterparts (MWCNT), but better suited due to their increased electrical properties. This project aims to test the viability of MWCNT's in serving a comparable function by measuring the change in resistance when exposed to certain gases. Five gases were tested: carbon dioxide, hydrogen chloride, nitrogen dioxide, methane, and ammonia. For methane and ammonia, the gas source to a Bunsen burner and ammonium hydroxide were used, respectively. The reaction to evolve carbon dioxide gas involved sodium hydrogen carbonate and hydrochloric acid; hydrogen chloride gas involved sodium chloride and sulfuric acid; nitrogen dioxide gas involved copper filings and nitric acid. They were then exposed to the surface of BuckyPaper, a sheet form of MWCNT, in various configurations depending on their densities. The scientist recorded the resistance of the BuckyPaper over a one minute period after exposure. For nitrogen dioxide, carbon dioxide, and hydrogen chloride, various concentrations were tested to represent the effect of different concentration of gas on the extent the resistance of the BuckyPaper was affected. Strong, linear, positive correlation between concentration of gas and magnitude of change in electrical resistance was recorded. BuckyPaper was concluded to be an excellent candidate for the future of next-generation gas sensing technology.

**Awards Won:**

Fourth Award of $500