CVD-based Thin Films as Affinity Layers in Chemical Detectors

Chemical sensing of volatile gases, warfare gases, and biological agents There is a growing need to develop gas sensors that are lightweight, cheap, and can detect a wide range of gases even at low concentrations. In particular, detection of volatile compounds and biological warfare agents plays a big role in security and warfare devices. These sensors must have high selectivity and sensitivity. Vapor-based thin film deposition of functionalized polymers have been shown to exhibit specific interaction with these volatile compounds. These thin films have a lot of flexibility in their surface functionalities and chemistry. Trace vapors can be quickly adsorbed and desorbed from these surfaces.

Thin films with gas detecting capabilities Chemical vapor deposition of functionalized hydrocarbons has shown lots of promise in producing thin films that are highly sensitive to the presence of volatile gases, even in humid environments. University of Michigan researchers have built upon this technique to deposit polymers onto various substrates and stainless wool, resulting in surfaces that range from superhydrophobic to superhydrophilic. They verified the thermal stability of the films up to 350°C, and tested the adsorption of organic vapors including acetone, sulfates, and phosphonates with great success. The binding of the vapors to the thin films is a reversible process, allowing the re-use of films and subsequent analysis of the preconcentrated desorped vapors. These films are economic to produce and are easy to integrate into existing sensors.

Applications • Mass spectrometry • Oil-water separators • Breath analyzers • Sensors for VOCs, TNT, biological agents • Personal VOC monitors Advantages • Functionalization allows customizability for different vapors • Ability to detect at low concentrations • Capability to detect even in humid conditions

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