Gas Sensor Research Based on Insect Wing Hierarchical Microstructure

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Today, the development of new gas sensors has become one of the most essential topics all around the world due to air pollution. At a camp in Tsinghua University in China, we accidentally found out that the hierarchical porous structure in the insect wings has the ability to improve the capabilities of gas sensors. Inspired by this, this research is going to utilize hierarchical microporous structure to create a new type of gas sensor. These are the main research contents: 1) The gas sensor component with butterfly wing powder proves that the butterfly wings acquire the ability of catching gases; 2) According to the biological template method, the production of gas sensitive material SnO2 with porous structure was designed; 3）Utilizing electron microscope to discuss the geometer of insect wings' microstructure. 4) Proving that only hierarchical porous structure is the foundation of improving gas sensor capabilities. 5) After Adopting liner regression to analyze the connection between gas sensor capabilities and the butterfly wing hole area, the patterns are discovered and shown as the equation: β=514-0.00017×α γ=13-5.7e-6×α（β = highest voltage, γ = speed, α = hole area）. 6) After comparing 30 kinds of different butterfly wing gas sensors, the best one has the characteristics of: 1. Complete microstructure; 2. Wide surface area; 3. Open hierarchical porous structure. 7) Analyzing the influences of precursor thickness, temperature, characteristics of tested gases and non-ideal working environment on the butterfly wing hierarchical microstructure gas sensors. 8）Utilizing the SnO2 with best butterfly structure to produce its gas sensors. After testing, the gas sensors' response speed is found at least 5.5 times faster and its sensitivity 2.5 times better.