Functionalized Low-Dimensional Nanostructures for Sensing Applications

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Noble metal nanoparticles possess remarkable attributes that make them ideal scaffolds for the development of highly sensitive sensing devices. Their inherently high surface-to-volume ratio, coupled with their unique optical and electrical properties, renders them extremely responsive to changes in their surrounding environment.[1] One of the key advantages of noble metal nanoparticles lies in their tunability through molecular functionalization. By modifying their surface chemistry with tailored molecular receptors, their properties can be finely adjusted to suit specific sensing applications. In my lecture, I will present our recent findings on the functionalization of gold nanoparticles (AuNPs) to engineer hybrid systems suitable for various sensing applications.

I will present a work focused on developing chemiresistors (CRs) using three dimensional (3D) networks of AuNPs bridged by supramolecular receptors (dithiomethylene dibenzo-18-crown-6 ether, DTDB-18C6) for potassium ions (K+) sensing. These CRs demonstrate linear sensitivity, high selectivity, stability, reversibility, fast response time, and compatibility with microfluidic systems, making them promising for point-of-care (POC) sensing, particularly in health monitoring.[2]

Furthermore, I will introduce a novel strain sensor employing AuNPs interconnected by flexible molecular linkers. This strain sensor, when deposited onto flexible supports, demonstrates exceptional sensitivity to both compressive and tensile strain. Its remarkable properties, including high flexibility, rapid response time, and robustness, enable high-resolution monitoring of artery pulse waves for accurate health assessment.[3]

Looking forward, continued exploration of noble metal nanoparticle functionalization holds promise for further advancements in sensing technologies, potentially revolutionizing healthcare and wearable monitoring devices. Additionally, leveraging these hybrid systems in other sensing applications could lead to breakthroughs in various fields, including environmental monitoring and industrial process control.

References

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Figures

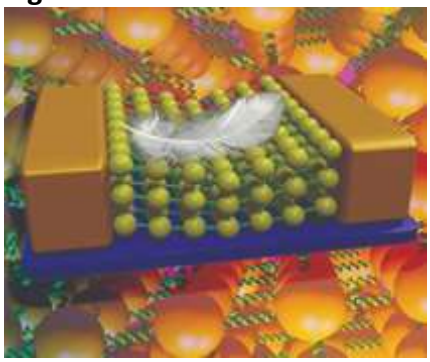

Figure 1: Strain sensor based on AuNPs interconnected by flexible molecular linkers.