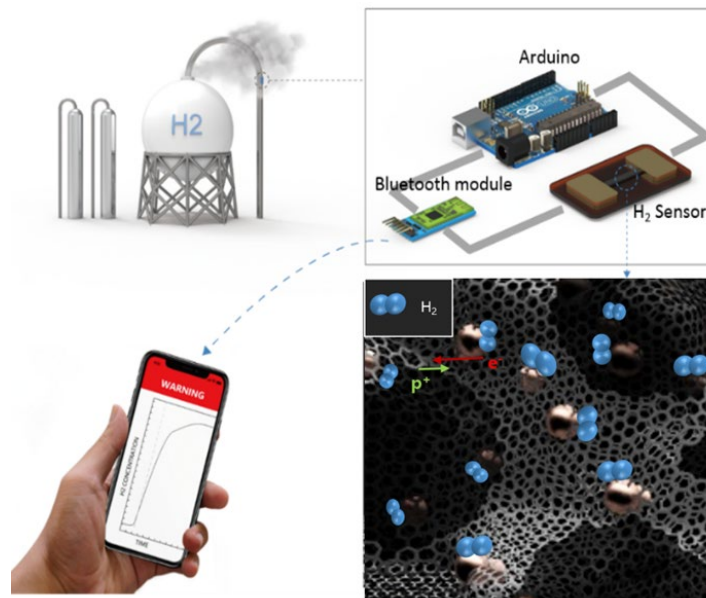


High Sensitivity Hydrogen Gas Leak Detection Sensors

This high-sensitivity sensor will be used to detect hydrogen leaks and prevent potential explosions. The sensing platform will be used to detect H₂ leaks from large industrial size hydrogen tanks and pipelines used in the petroleum and fertilizers industries. The sensing platform also detects leaks from hydrogen fuel cells that power vehicles and from residential hydrogen fuel cell generators. The sensors use a nano-assembly of three-dimensional (3D) porous graphene and palladium nanoparticles (PdNPs) as active materials. While hybrid materials based on graphene and PdNPs have been known as suitable for high-performance hydrogen detection, fabricating these materials has been challenging and expensive. The invention provides a reliable, scalable and inexpensive method for synthesizing the nano-assembly of 3D graphene and PdNPs. The novel process allows for the design of commercially viable high-performance and inexpensive hydrogen leak detection systems, moving this technology from the lab to the market.

The described invention is a commercially viable method for fabricating the nano-assembly of three-dimensional (3D) porous graphene and palladium nanoparticles (PdNPs). The invented method uses laser photothermal processing of homogenous polymer films containing Pd-ligands to form nano-assemblies of 3D graphene and PdNPs - which is the active material of the sensor. The resulting sensors have high electrochemical responsivity and reversibility resulting in high-sensitivity (as low as 1 part per million) and high reusability. The sensors also have outstanding mechanical integrity, flexibility, and durability to bending and twisting. Once the sensors are integrated into wireless sensing platforms, the result will be a new class of high-performance and inexpensive hydrogen sensors that are commercially viable in many applications.



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