HydroSens - prototypes of room temperature hydrogen sensors

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Industrial processes incorporating hydrogen are increasingly prevalent, necessitating the implementation of stringent safety measures to mitigate the risks of hydrogen fires and explosions. Reliable, real-time monitoring of hydrogen gas concentrations is a critical component of these safety protocols. However, current hydrogen sensor solutions exhibit several limitations. For example, the sensors may act as potential ignition sources due to their requirement for elevated operating temperatures, they offer a limited detection range, and they often respond sluggishly to abrupt changes in hydrogen concentration. Additionally, these sensors incur high costs both in terms of initial investment and ongoing operation.

Based on our previous research, our project posits that sensors based on polycarbazole, which is a well-known conjugated polymer that has found application in organic photovoltaics, corrosion protection and gas sensing, represent the most cost-effective solution, capable of operating at ambient temperatures.

The results of our investigations show that polycarbazole-based sensors are sensitive to hydrogen gas in the range of 1-4% (and even in further research sub ppm concentrations of hydrogen) at room temperature. Obtained sensor are also selective to hydrogen in different interferents such as air, methane. Simultaneously, they have been fabricated using an inexpensive, cost-efficient and repeatable method, making for a promising sensing material.

The primary innovative objective of the proposed project is to address the requirements of the hydrogen industry by developing an efficient solution for hydrogen gas detection in industrial environments. This approach aims to overcome the previously identified limitations and to meet the specific needs of technologies and processes involved in the production, storage, and handling of hydrogen.

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