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POROUSENSE: Protecting the North Sea from Oil Leaks

A MOF-based QCM sensor prototype to monitor methane levels near abandoned offshore wells

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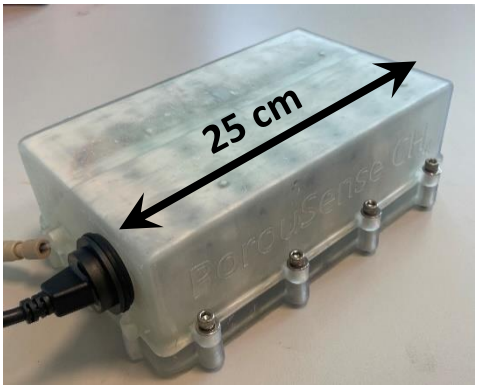
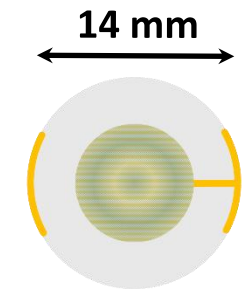
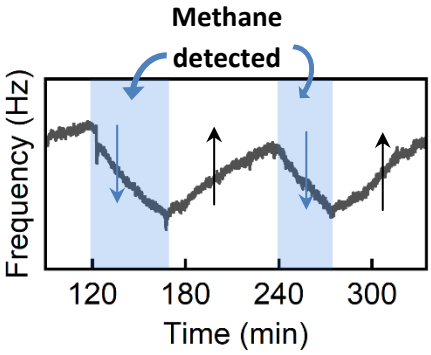
This work presents a compact sensor prototype designed for detecting methane leaks from abandoned offshore wells. The sensor employs a metal-organic framework (MOF) specifically engineered to selectively adsorb dissolved methane from water. Integrated with quartz crystal microbalance (QCM) technology, the sensor can detect minuscule mass changes (5–500 nanograms) that occur when methane enters the MOF (a porous material) inducing a shift in the resonance frequency of the quartz.

The sensor prototype is housed within a 3D-printed flow cell enclosed in a watertight casing and equipped with a micropump for continuous water sampling. This setup allows for real-time monitoring of frequency shifts and demonstrates effective methane leak detection under laboratory conditions.

The resulting prototype offers a cost-effective and rapid solution (response time under 5 minutes) for methane leak detection in aquatic environments, with the potential for remote operation. By blending advanced functional materials with practical engineering design, this approach paves the way for marine protection through the development of sensors for environmental pollutant monitoring.







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