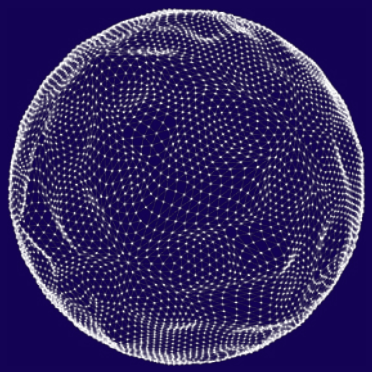


PiPe4.0

Innovative Nano and Laser Pipe Sensors for In Situ Gas Monitoring

PUBLIC SUMMARY

The decarbonization of gas supply and subsequent reconfiguration of gas flows through the grid will substantially affect the business case of gas network operators. In particular, biogas, biomethane and hydrogen-enriched natural gas will play a crucial role in the coming years, requiring new paradigms for gas monitoring.

PiPe4.0 project will address two main issues related to in-situ monitoring in the distribution gas network by realizing a system consisting of two interconnected units:

1. Main unit (Gas Monitoring Unit, GMU) able to perform a complete measurement of the gas parameters in injection cabins or gas distribution cabins. This unit addresses the issue of measuring the gas parameters in a reliable, fast and cheap way. It is directly applicable to a wide distribution of mixtures without any hardware reconfiguration or any needs of consumable supplies, ready for IoT operation. It is designed to work in a very wide range of environmental conditions that are found on gas pipelines, including remote unmanned locations.
2. Network of distributed self-powered secondary sensors (Distributed Sensing Unit, DSU) that measure hydrogen content and/or pressure in different points and can provide feedback on the parameters to be used in the injection process and/or on the status of the distribution network. The measure of hydrogen concentration with such network is strategic, since these distributed sensors can detect continuously local leakages providing an extremely valid alternative to time-consuming detection from outside the network.

The PiPe4.0 final implementation will be demonstrated and industrially proven in two different pilot plants to perform on-field demonstration of the operation of the GMU and DSU in real conditions. The system will be demonstrated for in-situ operation in real operative conditions within two test cases:

- An injection cabin for hydrogen-enriched natural gas and biomethane in the distribution network.
- A biogas generation plant for electric energy production.

Advantages of the PiPe4.0 system are:

1) Gas monitor unit:

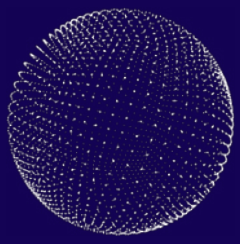
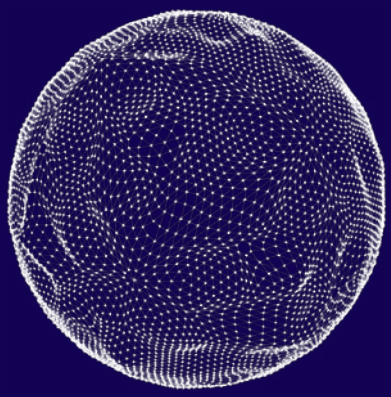
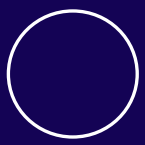
- Integrated system able to measure in-situ the main parameters of fuel gases in the distribution network.

- Composition and heating value of fuel gases measured according to BS EN ISO 6976:2016.
- System suitable for a broad set of gas mixtures within an extremely variable range of compositions.
- Compact, low-cost and low-power instrument, fully automated operation.

2) Distributed sensing unit

- Distributed gas parameters (pressure and/or hydrogen content) measured and transmitted to the monitor unit to characterize the gas injection process.
- Full monitoring of gas leakages all along the line.
- Self-powered sensors.
- Tribo/thermoelectric combination for energy harvesting which takes advantage of the continuous gas flow in the pipes and generates a constant electrical energy production.
- Suitability for harsh environments.

PiPe4.0 aims to establish a new measurement paradigm in the field of fuel gas distribution and sensing.

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