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Raman Spectroscopy of Gasses using Hollow Core Micro-Structured Optical Fibres

ISI have been working in collaboration with the Optoelectronics Research Centre (ORC) at the University of Southampton to develop a flexible on-line gas detection instrument with high specificity and sensitivity that can measure several gas species simultaneously, **Figure 1** - LHS. The Raman spectroscopy-based system uses a state-of-the-art hollow core fibre (HCF), a micro-structured silica fibre with a tubular hollow core which can be filled with the sample gas. The HCF facilitates an extended interaction pathlength between the excitation laser and the confined gas thereby enhancing gas measurement sensitivity. This approach also demands only very small sample volumes (microlitres).

Using the prototype design, a test program was funded through the SBRI on demonstrating the quantification of gas species of interest to the nuclear industry, ranging from simple diatomic gases e.g. H_2 to potential contaminants such as heteronuclear vapor phase organic species. Results showed excellent linear response across the target concentrations and the potential for low limits of detection. Another recent project targeted the detection of component species within a natural gas/ hydrogen blend sample. Ethane, methane, and hydrogen were all successfully detected using the HCF based Raman technique. The instrument development is currently focused on enhancing the limit of detection (LoD), by changing properties of the HCF and some mechanical variation in optical components, the current LoD is estimated at <2ppm, a 10ppm methane sample can been seen in **Figure 1** – RHS.

ISI is currently working on an SBRI UK funded project for the analysis of tritium in the nuclear fusion sector. In collaboration with Jacobs and the ORC, and funded through the Fusion Industry Program, ISI aim to demonstrate reliable performance in a variety of demanding deployment scenarios for this sector, as well as ensuring the compatibility of the instrument in the required environmental conditions.

Figures

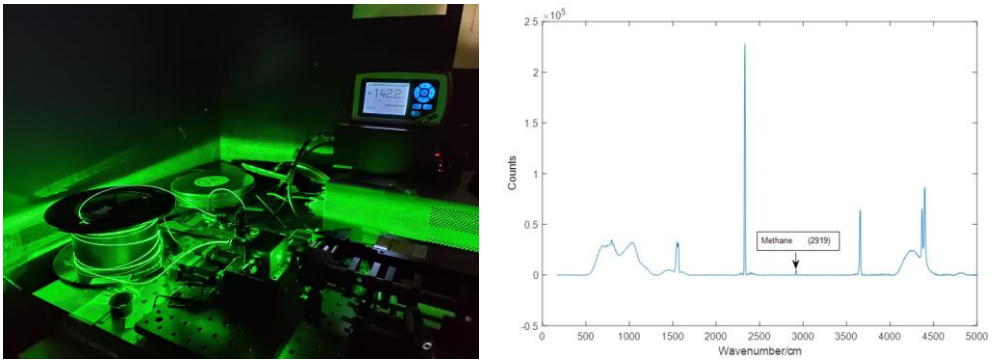

Figure 1: The gas Raman instrument (LHS) and the Limit of Detection testing, Raman spectrum showing 10ppm methane detection (RHS)