



DETERMINATION OF HOT GAS TEMPERATURE PROFILES BY IR SPECTROSCOPY

R. CONSEIL^{1,2,c}, D. RAMEL³, J. LEBEDINSKY¹, Y. BAILLY³, P. HERVÉ¹

¹LEME – Laboratoire d'Énergétique de Mécanique et d'Électromagnétisme, Ville d'Avray, FRANCE

²LASUR – Asnières sur Seine, FRANCE

³Institut FEMTO-ST – Franche-Comté Electronique Mécanique Thermique et Optique - Sciences et Technologies, Belfort, FRANCE

^cCorresponding author: Tel.: +33140974819; Email: robin.conseil@hotmail.fr

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Other keywords: infrared spectroscopy

ABSTRACT: Determination of exhaust gas temperature and concentration is a critical point for the study and the optimization of engines combustion. A non-invasive method has been developed based on the analysis of the CO₂ infrared spectrum, which is particularly sensitive to the temperature between 4.16 μm and 4.20 μm [1]. Inversion of the radiative transfer equation ensures the retrieval of temperature and concentration profiles, from transmission or radiative intensity measurement and complementary information about the profiles shape.

The inverse problem is solved by minimizing the quadratic difference between the measured spectrum and the calculated one from the spectroscopic data listed in HITRAN-08 [2] [3] [4]. This method has been validated on a flowing CO₂/N₂ gas mixture heated up to 300°C. Identified temperature has shown good agreement with the one recorded by thermocouple: difference was less than 2.5%. This optical technique, without medium disturbance, may be used in various applications involving combustion, such as the study of Diesel exhaust pipe as shown in figure 1.

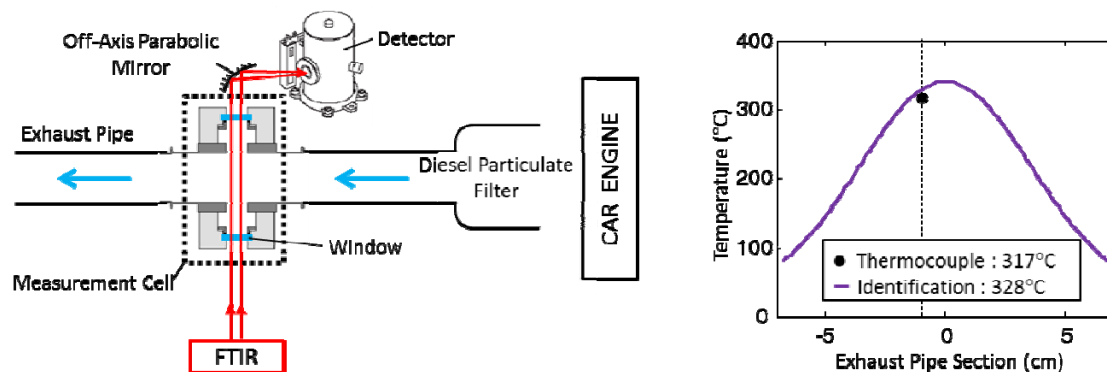


Fig. 1 Instrumentation set-up for radiative measurement of exhaust CO₂ (left), comparison between thermocouple measurement and inversion process (right).

References

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