

CLAIMS:

1. A system (1000) for in-situ gas analysis in a flue gas region (65), wherein said system (1000) comprises:
 - An enclosure (10);
 - 5 • A laser beam source (20) housed in said enclosure (10), said laser beam source (20) configured to generate laser beams;
 - A tubular probe insertable for probing in the flue gas region (65), said probe comprising:
 - 10 ○ optical waveguides (60) configured to receive and conduct laser beams generated by said laser beam source (20);
 - a dead zone (30) configured to support and isolate said optical waveguides (60) contained therein from surrounding flue gases, said optical waveguides (60) extending upto and projecting said generated laser beams from the farther end of said dead zone (30);
 - 15 ○ a measurement zone (40) configured to receive said projected laser beams by said optical waveguides (60), said measurement zone (40) configured to allow said flue gas to pass therethrough and get exposed to said projected laser beams; and
 - 20 ○ a reflection chamber (50) located at the farther end of said measurement zone (40), said reflection chamber (50) comprising a first focusing lens (52) for focusing said projected laser beams that are exposed to said flue gases in said measurement zone (40), and a mirror (54) for reflecting back said focused laser beams towards said optical waveguides (60);
 - at least one detector (70) configured to detect said at least one reflected laser beam and generate at least one corresponding sensed signal; and
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- a processing unit configured to process said sensed signal from said detector (70) for computing composition of said flue gas.
2. The system (1000) as claimed according to claim 1, wherein said laser beam source (20) is configured to allow tuning of the frequency spectrum of the laser beam generated for identification of particular molecules present in the flue gas being analyzed.
 3. The system (1000) as claimed according to claim 1, wherein said tubular probe comprises an insulation-cum-support tube (32) along the dead zone for thermally insulating as well as structurally supporting the optical waveguides (60).
 4. The system (1000) as claimed according to claim 3, wherein said insulation-cum-support tube (32) consists of a first shield (32a), a second shield (32b) and an air jacket (32c) defined by the space between said first shield (32a) and said second shield (32b), said air jacket (32c) being configured to allow compressed air at ambient temperature to flow therethrough.
 5. The system (1000) as claimed according to claim 1, wherein said enclosure (10) is temperature-stabilized and is configured to be positioned external to said flue gas region (65).
 6. The system (1000) as claimed according to claim 1, wherein said detector (70) includes a laser-optical sensor (72).
 7. The system (1000) as claimed according to claim 1, wherein said measurement zone (40) is provided with a diffuser (42) which allows diffusion of flue gases from the surrounding flue gas region (65) into the measurement zone (40).
 8. The system (1000) as claimed according to claim 1, wherein said measurement zone (40) is an open path cell.
 9. The system (1000) as claimed according to claim 1, wherein said optical waveguides (60) include a plurality of transmitting cables (60a) for transmitting said generated laser beams and projecting said generated laser beams into said measurement zone

(40) and at least one receiving cable (60b) for receiving said reflected laser beam and transmitting said reflecting beam to said detector (70).

- 5 10. The system (1000) as claimed according to claim 9, wherein said optical waveguides (60) include a plurality of sets of transmitting cables and a plurality of receiving cables, said plurality of sets of transmitting cables includes at least a first set of transmitting cables (601a) and a second set of transmitting cables (602a) for transmitting and projecting first generated laser beams containing a first frequency band and second generated laser beams containing a second frequency band respectively, and said plurality of receiving cables includes a first receiving cable
10 (601b) and a second receiving cable (602b) for receiving and transmitting a corresponding first reflected laser beam and a corresponding second reflected laser beam respectively.
- 15 11. The system as claimed according to claim 10, wherein said reflection chamber (50) comprises at least two mirrors (54a, 54b) positioned one after the other along the longitudinal axis of said reflection chamber (50), wherein a first mirror (54a) is configured to reflect said first generated laser beam and a second mirror (54b) is configured to reflect the second generated laser beam.
- 20 12. The system as claimed according to claim 11, wherein said detector (70) comprises a second focusing lens (74) for focusing a plurality of reflected laser beams including said first reflected laser beam and said second reflected laser beam.
13. The system (1000) as claimed according to claim 12, wherein said dead zone (30) comprises a collimation lens assembly (34) positioned at the farther end of said dead zone (30).
- 25 14. The system (1000) as claimed according to claim 1, wherein said enclosure (10) houses a plurality of gas cells (22) provided for calibration, with one gas cell (22) per laser beam source (20).

15. The system (1000) as claimed according to claim 1, wherein said optical waveguides (60) are made of chalcogenic cylindrical raw material such as As-Se, As-Se-Te, or Ge-Sb-Se, or are hollow waveguides.
16. The system (1000) as claimed according to claim 1, wherein said first focusing lens (52) formed by a group of lens which includes convex lens and fresnel lens.
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