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Fiber lasers: Detection of gases and chemicals

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Fiber lasers operating either in the CW or PULSED mode are established as robust and reliable devices. They have wide applications in industry and medicine because of their unique characteristics such as an all-fiber design, compact size, cost-effective production and operation, and lack of need for re-alignment and external cooling. A fiber laser emitting single-longitudinal-mode, single-wavelength or multi-wavelength output in the infrared region of the electromagnetic spectrum is attractive for applications in optical communication, sensing, spectroscopy and nonlinear optics.

Trace-gas sensing is a rapidly growing field. It has applications in breath diagnostics, environmental monitoring, and homeland security. Several methods and devices are commercially available for the identification and quantification of trace gases. Most of the commonly used devices are based on gas chromatography (GC) coupled with mass spectroscopy (MS). Laser spectroscopy is an alternative to the GC/MS methods. Laser spectroscopy is based on the light-absorbing property of a chemical and can detect a compound in real time with very high sensitivity. The author has developed a new technique, based on a CW fiber laser, for the detection of trace gases. In the talk, the author will present the details of the gas detection system and its unique features.

Further, detecting a single molecule of a substance (e.g. the protein responsible for cancer) is a real challenge using existing devices, most of which are also very expensive. A system based on fiber lasers will be efficient and cost-effective. The author will also present the details of a chemical sensor based on SERS (Surface Enhanced Raman Spectroscopy).

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