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Novel Method Generates Powerful and Portable Mid-Infrared Lasers for Detecting Pollutants

By Daniel Hall

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Scientists at Nanyang Technological University, Singapore (NTU Singapore) have made a groundbreaking discovery in laser technology that could revolutionize the detection of pollutants and hazardous gases. By using specially made optical fibers with hollow cores, the researchers have developed a novel method to produce intense and ultra-fast mid-infrared lasers. These lasers are crucial in the creation of highly sensitive devices capable of detecting trace amounts of substances that are otherwise difficult to identify.

Traditionally, mid-infrared lasers have been used to quickly analyze the composition of air, detecting greenhouse gas pollutants, toxic substances, explosives, and even diseases present in a person's breath. However, the existing methods of generating these lasers have limitations. One method requires controlled laboratory conditions, free from disturbances such as vibrations and changes in temperature and humidity, making them unsuitable for outdoor use. Another method can withstand environmental interferences, but the lasers lack the necessary intensity to accurately detect minute amounts of substances.

The NTU Singapore researchers addressed these challenges by utilizing hollow-core fibers with carefully adjusted sub-structures. By manipulating the thickness of the fiber's mini tubes, the team successfully produced bright mid-infrared lasers within the electromagnetic spectrum. These lasers have wavelengths of 2–20 micrometers and offer distinct advantages over other lasers when it comes to substance detection.

With the new method, portable and powerful mid-infrared laser generators can be developed without the need for controlled laboratory environments. This allows users to pair the lasers with detectors and identify a wide variety of unknown substances directly in the field, without the need for time-consuming lab testing.

This groundbreaking research, led by Nanyang Assistant Professor Chang Wonkeun, represents a significant step forward in laser technology. The team's findings have been published in the prestigious journal Laser & Photonics Reviews.

Frequently Asked Questions (FAQ)

Q: What are mid-infrared lasers?
Mid-infrared lasers are lasers with wavelengths ranging from 2 to 20 micrometers. They are particularly useful in substance detection due to the unique ways in which different molecules absorb lasers in this range.

Q: How are the newly developed mid-infrared lasers different from existing ones?
The newly developed lasers are generated using hollow-core fibers with adjusted sub-structures. This design allows for the production of intense and ultra-fast mid-infrared lasers that can accurately detect trace amounts of substances.

Q: Can these lasers be used outside of laboratory settings?
Yes, the novel method developed by the NTU Singapore researchers enables the creation of portable mid-infrared laser generators. These lasers can be utilized in the field without the need for controlled and vibration-free environments.

Q: What are the potential applications of these powerful mid-infrared lasers?
The applications of these lasers are vast. They can be used to quickly identify pollutants, toxic substances, explosives, and diseases present in a person's breath. The portable nature of the lasers allows for on-the-spot testing, eliminating the need for sending samples to laboratories.

Q: Are mid-infrared lasers affected by the presence of water molecules in substances?
Unlike other lasers, mid-infrared lasers are not affected by the presence of water molecules in substances. This makes them highly accurate and reliable for substance detection even when water is present.

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