Researchers develop a black phosphorus all-fiber humidity sensor

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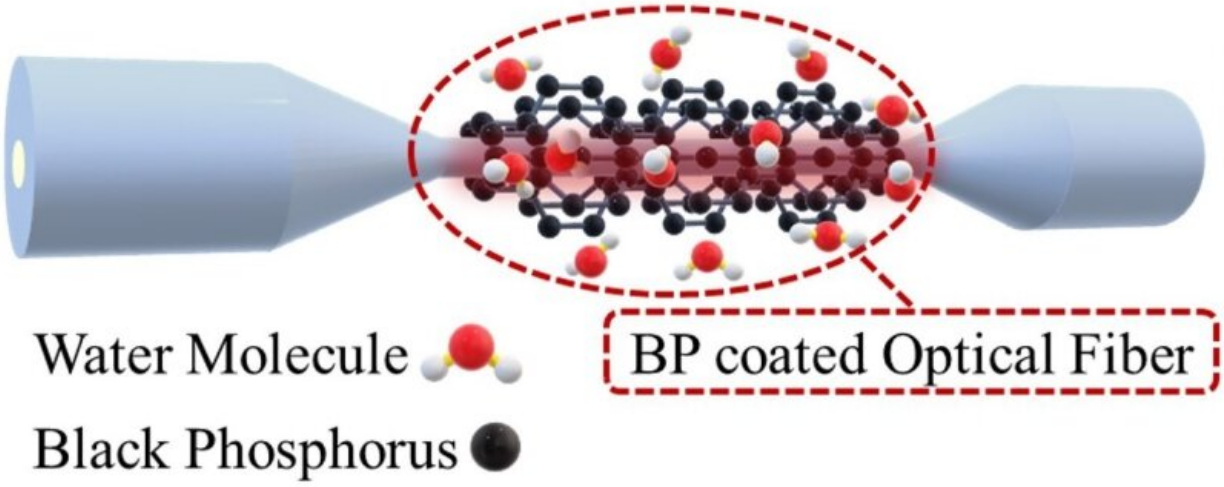

Transmission path of light in BP-coated ESMF. Credit: LI Jia

A research group led by Prof. LI Jia and Prof. XU Xuefeng from the Shenzhen Institutes of Advanced Technology (SIAT) of the Chinese Academy of Sciences, along with Prof. YANG Dexing from Northwestern Polytechnical University, developed a highly responsive all-fiber humidity sensor with an ultrafast response time as fast as 7ms.

Humidity, the concentration of water vapor present in the air, is an important reference value in many aspects of life and production.

Fiber optics offers a significant photonic strategy for high-performance sensing effect. Apart from the inherent merits of fiber optics, such as compact size, light weight, immunity to electromagnetic interference, low cost, and high reliability, the fiber-based optical sensors promises high sensitivity, fast response, and in-line determination as well.

The researchers integrated black phosphorus (BP) nanosheets with etched single-mode fiber (ESMF), which was different from traditional transistor-based BP humidity sensors.

The single mode fiber was directly coated with BP nanosheets. The light passed through the fiber core and yielded an evanescent wave penetrated into BP coating, leading to a strong light-matter interaction for moisture detection and realizing highly responsive humidity sensor.

"This device takes advantages of sensitivity and fast response of both fiber-optics and black phosphorus to environmental changes," said Prof. LI. "We hope our work can provide an all-optical sensing platform for high-performance humidity sensing, and open up new opportunities for potential vapor/gas sensing applications in the fields of biomedical, chemical and environmental science."

The study was published in *physica status solidi (RRL) - Rapid Research Letters*.

More information: De Yu et al. Black Phosphorus All-Fiber Sensor for Highly Responsive Humidity Detection, *physica status solidi (RRL) – Rapid Research Letters* (2020). DOI: 10.1002/pssr.201900697

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