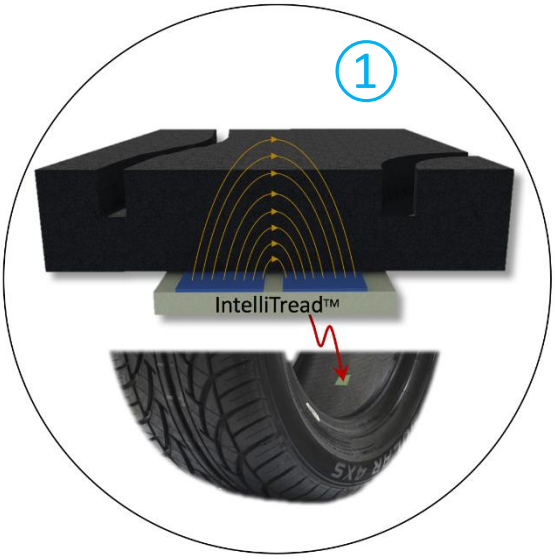
Tyrata Technology Backgrounder

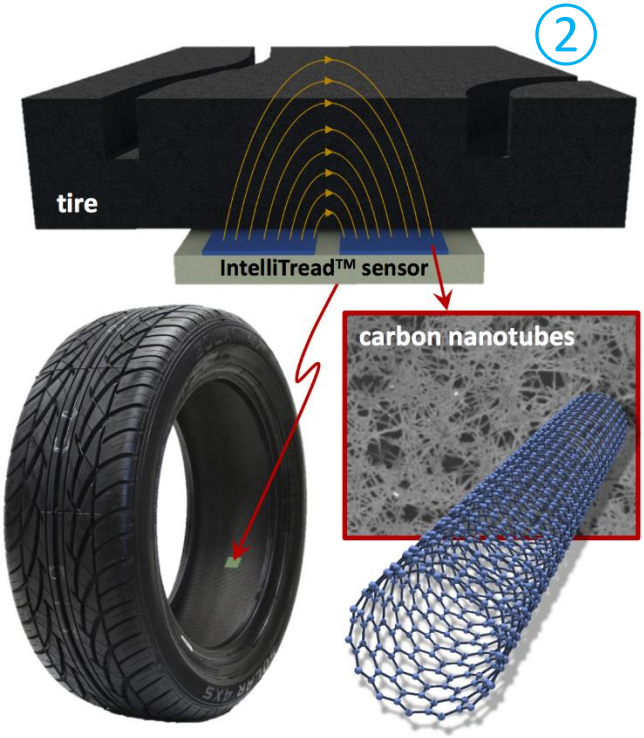
Intelligent Tread Wear Systems℠

Tyrata, Inc. is a sensor development and data management company offering wireless sensors and systems that monitor and report on vehicular tire tread wear in real time. Tyrata's IntelliTread™ technology monitors, tracks and predicts tire tread wear over the life of any tire.



In collaboration with Duke University, Tyrata's founders developed the sensor technology using carbon nanotubes (tiny cylinders of carbon atoms just one-billionth of a meter in diameter) that can track millimeter-scale changes in tread depth with 99 percent accuracy. The sensors could easily signal when it's time to replace tires or report information about uneven and often dangerous tire wear conditions.

The technology relies on the well-understood mechanics of how electric fields interact with different materials. The core of the sensor is formed by placing two small, electrically conductive electrodes side-by-side, very close to each other on the inside of the tire, directly below the tread (1). Importantly, the sensor can operate without being embedded into the tire's tread, making it applicable to any tire at the time of installation (2). By applying an oscillating electrical voltage to one electrode and grounding the other, an electric field forms between the electrodes.



While most of this electric field passes directly between the edges of the two adjacent electrodes, some of the field arcs from the face of one electrode to the face of the other, with the arc penetrating up into the tire tread. The tire rubber and tread structure interfere with this so-called "fringing field" and by measuring this interference through the electrical response of the grounded electrode, it is possible to determine the thickness of the tire above the sensor.

While there is a limit to how thick a material this setup can detect, it is more than enough to encompass the centimeter or two of tread found in today's tires. Testing of the sensors on consumer and commercial tires has provided evidence of sub-millimeter resolution, which means that the technology could easily tell drivers when it's time to buy a new set of tires. In a more sophisticated

implementation, the technology could provide information about uneven and often dangerous tire wear by connecting numerous sensors in an array to cover the width of the tire.

Importantly, tests have also proved that the steel belt (metal mesh) embedded within tires does not disrupt the operation of the sensors.

While the sensor could be made from a variety of materials and methods, researchers optimized performance by exploring different variables from sensor size and structure to substrate and ink materials. The best results were obtained by printing electrodes made of carbon nanotubes on a flexible polyimide film (3). Besides providing the best results, the carbon nanotubes are durable enough to survive the harsh environment inside a tire.

Headquarters Location

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