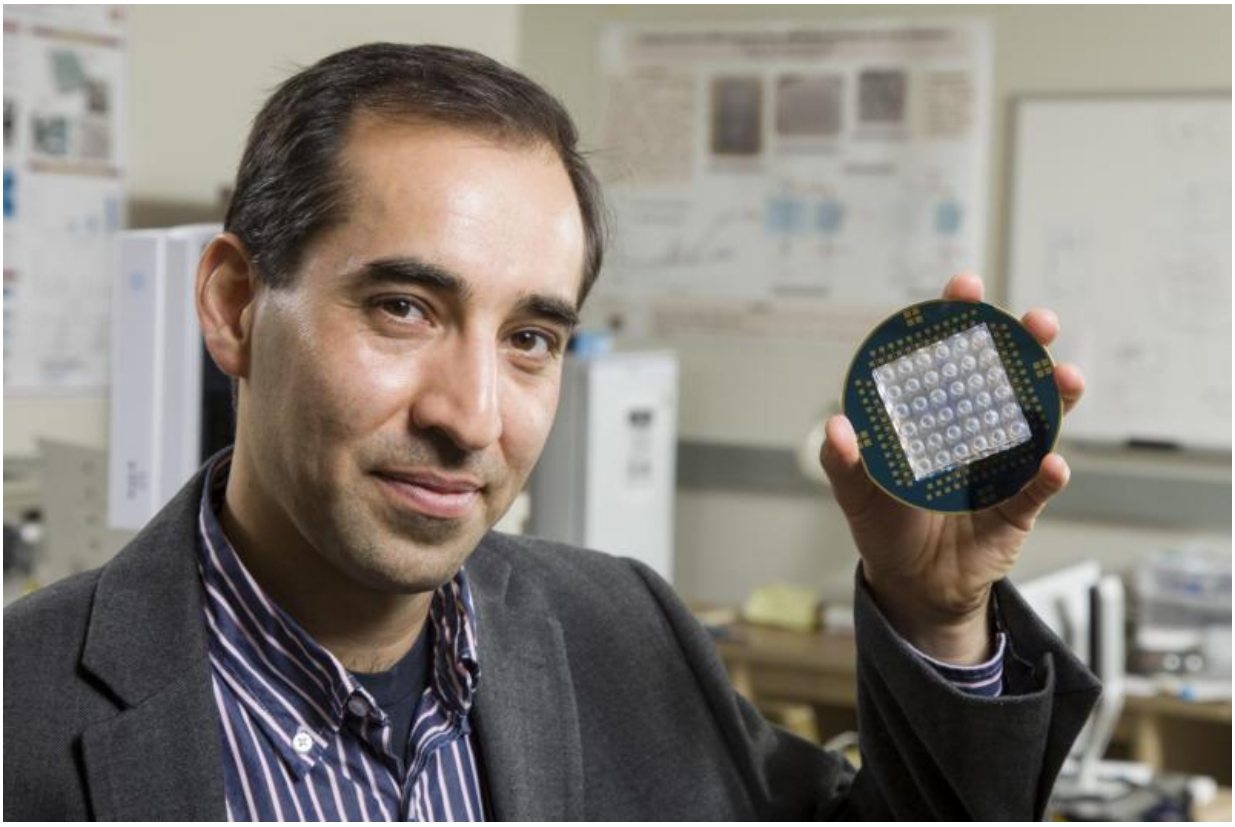
# New technology provides superior ability to rapidly detect volatile organic compounds

April 13 2015



Masoud Agah, of Virginia Tech's Bradley Department of Electrical and Computer Engineering, is holding up a microelectrode array, used for real time electrical recording of cellular activity. Credit: Virginia Tech

Over the past several decades, the progress in micro fabrication technology has revolutionized the world in such fields as computing,

signal processing, and automotive manufacturing.

Making various types of instruments smaller is another example of how the use of this technology has produced significant advancements. One such instrument is the gas chromatography system used in a number of scientific, medical, and industrial settings to separate and analyze dangerous, volatile organic compounds in gases, liquids, and solids.

For the past several years, Masoud Agah, an associate professor in Virginia Tech's Bradley Department of Electrical and Computer Engineering, has used a National Science Foundation award to develop a credit-card-sized gas chromatography platform that can analyze volatile compounds within seconds.

"The advantages that such miniaturized instruments can provide include the portability for analysis in remote locations with high throughput and low cost," Agah said. A war zone might be considered a remote location.

In conducting his research, Agah identified a problem that allowed him to develop his new technology. He explained that the research community has more actively pursued "the hybrid integrated approach" for the development of micro gas chromatography system and this method is relatively "less vibrant in the monolithic integrated approach."

Agah explained that the hybrid integration approach allows the major components of the system, to be miniaturized individually on separately fabricated chips. These components are then manually assembled using commercially available off-chip fluidic interconnects.

"This hybrid integration method leads to an increase in the fabrication cost since it involves the separate processing of the individual components," Agah added..

"The manual assembly of the individual components is really a cumbersome job and increases the overall weight and footprint of the micro gas chromatography system. To some extent; the hybrid integrated approach is inconsistent with the purpose of micro gas chromatography research since further improvement in terms of size, cost, and performance can be achieved by the single chip or monolithic integration of micro gas chromatography components" he added.

His most recent advancement in this area is the subject of an article appearing in a peer-reviewed journal of the Royal Society of Chemistry called *Lab on a Chip*. Agah and his graduate students Muhammad Akbar (Islamabad, Pakistan), and Dr. Hamza Shakeel (Rawalpindi, Pakistan), developed a unique gas chromatography-on-chip module.

"The experimental results are really encouraging and address the deficiencies I described," Agah revealed. "The gas chromatography on-a-chip provides highly efficient separations and detection, reduced analysis times using temperature and flow programming, as well as fast detection response times suitable for high-speed gas chromatography."

The system's reliability was also impressive. Results were found to be highly repeatable with less than 10 percent variations, and no deterioration of the detector excitation electrodes was observed after 12 hours of continuous operation.

Provided by Virginia Tech