Credit-card-sized platform for volatile compound analysis CAREER project goal

February 18 2008

Developing a credit-card-sized gas chromatography platform that can analyze volatile compounds within seconds is the next step for Virginia Tech College of Engineering researcher Masoud Agah, who has received a National Science Foundation (NSF) Faculty Early Career Development Program (CAREER) Award to support his research.

Agah, an assistant professor in the Bradley Department of Electrical and Computer Engineering and an affiliate member of the Department of Mechanical Engineering faculty, recently secured a five-year CAREER grant worth $400,000. This is the NSF's most prestigious award for creative junior faculty who are considered to be future leaders in their academic fields.

Gas chromatography is the primary technique used in a number of scientific, medical, and industrial settings to separate and analyze volatile compounds in gases, liquids, and solids.

Medical researchers, for example, can isolate volatile organic compounds in breath samples for early diagnosis or evaluation of certain metabolic conditions and diseases. Acetone in a patient's breath can be a marker for diabetes, Agah said, and scientists have identified a group of compounds that appear to be markers for breast cancer.

Gas chromatography is used in the field of environmental monitoring to identify certain air pollutants and drinking water and groundwater contaminants. Homeland security and military personnel can rely on the technique to test air samples for chemical warfare agents, such as sarin and mustard gases. The technique also is widely used in food processing, the petrochemical industry, and a number of other fields.

Currently, gas chromatography systems consist of a gas tank, sample injector, separation column, and gas detector. Samples to be analyzed are vaporized and injected into the column, where compounds are separated and then passed over the detector. Conventional systems tend to be large, fragile, and relatively expensive table-top instruments.

Agah, who established the Microelectromechanical Systems (MEMS) Laboratory (www.ece.vt.edu/mems/) at Virginia Tech shortly after joining the university in 2005, is attempting to develop a gas chromatographic architecture that will fit on a platform the size of a credit card and will separate and analyze a complex range of compounds in only a few seconds.

To create this new architecture, which he has named “GC Matrix,” Agah is employing MEMS technology. In his laboratory, he is developing gas chromatographic columns with heaters, temperature sensors, pressure sensors, and thermal conductivity detectors that can fit on micro-chips. Agah already has developed columns that can separate a limited number of volatile compounds and chemical warfare agent simulants in less than 10 seconds.

In addition to significantly improving the speed, portability, and performance, Agah’s GC Matrix will consume far less power than conventional instruments.

Once perfected, the GC Matrix could be used in a number of industrial and scientific applications. The apparatus also could be effective in saving lives during crises. Emergency workers, for instance, could easily carry GC Matrix instruments into areas devastated by floods to test water for toxic chemicals, and soldiers on the battlefield could test the air within seconds for signs of chemical warfare agents.

Every CAREER award project includes an educational component. Agah will develop a new university laboratory course on MEMS technology. He also is working with Virginia Tech's National Society of Black Engineers and the Institute of Electrical and Electronics Engineers' Teacher in Service Program to establish the High-School Microsystems Engineering Program.

Source: Virginia Tech

Citation: Credit-card-sized platform for volatile compound analysis CAREER project goal (2008, February 18) retrieved 3 May 2024 from https://phys.org/news/2008-02-credit-card-sized-platform-volatile-compound-analysis.html