Affordable sensor could detect a single molecule of carbon dioxide

Researchers at the Universities of Toronto and St. Francis Xavier are developing an affordable, energy efficient and ultra-sensitive nanosensor that has the potential to detect even one molecule of carbon dioxide (CO_2).

Current sensors used to detect CO_2 at surface sites are either very expensive or they use a lot of energy. And they're not as accurate as they could be. Improving the accuracy of measuring and monitoring stored CO_2 is seen as key to winning public acceptance of carbon capture and storage as a greenhouse gas mitigation method.

With funding from Carbon Management Canada (CMC), Dr. Harry Ruda of the Centre for Nanotechnology at the University of Toronto and Dr. David Risk of St. Francis Xavier are working on single nanowire transistors that should have unprecedented sensitivity for detecting CO_2 emissions.

CMC, a national network that supports game-changing research to reduce CO_2 emissions in the fossil energy industry as well as from other large stationary emitters, is providing Ruda and his team $350,000 over three years. The grant is part of CMC's third round of funding which saw the network award $3.75 million to Canadian researchers working on eight different projects.

The sensor technology needed to monitor and validate the amount of CO_2 being emitted has not kept pace with the development of other technologies required for carbon capture and storage (CCS), says Ruda.

"This is especially true when it comes to surface monitoring verification and accounting (MVA)," he says. "Improving MVA is essential to meet the potential of carbon capture and storage."

And that's where the ultra-sensitive sensor comes in. "It's good for sounding the alarm but it's also good from a regulatory point of view because you want to able to tell people to keep things to a certain level and you need sensors to ensure accurate monitoring of industrial and subsurface environments," Ruda says.

The sensors could provide complete topographic and temporal mapping of carbon emissions, which would help in the design of new protocols for carbon storage and recovery systems as well provide the means for enforcing regulations—all of which will enable markedly reduced emissions. Risk's role will be in testing and translational work that will help embed the sensors in these real-world application environments.

"The way things behave at that nano scale is different than the traditional or micron

scale," says Ruda. "We've been working in this area for nearly 20 years and we are among the leaders in developing the know-how for nanosensors."

Ruda says the project will initially prove the sensor is capable of detecting very small amounts of carbon, but eventually it could be used to detect other emissions in a variety of industries.

Source: Carbon Management Canada [1]

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