



Janne Liponen, a Master of Science in energy technology, and Marko Oikarinen, Managing Director, explain how materials can be given a voice.

# A new measuring technology opens a view into structures

Mato Engineering Oy, a Finnish start-up, has developed a measuring technology that enables sensors to be used for monitoring conditions in, for example, structures, cast concrete and asphalt.

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PHOTO JOONA RAEVUORI

**M**ato Engineering's measuring technology is based on a combination of electronics and materials technology. According to **Marko Oikarinen**, Managing Director of Mato Engineering, the technology offers a whole new approach to measuring.

The sensors can be used to measure moisture and temperature in structures. A sensor mounted in asphalt, in turn, can be used to monitor the freezing of the road surface.

- The sensors have a very durable structure. They maintain

their measuring ability even if they are occasionally immersed in water. Moreover, an alkaline environment has hardly any impact on the measurements. Since the sensors are mounted inside structures, the results are immune to human error, Oikarinen explains.

It has taken around four years of development and piloting for the technology to emerge as ready products. Oikarinen expects the sensors to take on an important role in sustainable construction.

Two of the four sensors, MATOlog CURE and MATOlog BOX, will be available on the market in December. The ROAD sensor, which alerts about slippery roads, and the FLOOD sensor, which alerts about flood risk, will be launched later.

## Revealing risk of mould growth

The MATOlog BOX sensor monitors temperature and moisture in various spaces, including base floors, roofing and wall structures.

The sensor features a mould model developed by VTT Technical Research Centre of

Finland and the University of Tampere. The algorithm that the model is based on uses history data to interpret the risk of mould growth in the structure or space.

The mould index is divided into six levels. The sensors alert about increased risk of mould before level one, that is, before any mould spores can even be detected by microscope.

- A moisture reading alone does not tell us anything. To assess the risk of mould, we need intelligence, and that is what our sensors can offer thanks to the measurements being linked to the mould model, Oikarinen clarifies.

## Control over cast concrete

The MATOlog CURE sensor enables the temperature, moisture and strength development of concrete to be monitored after casting. Later, when the building is in use, the sensor detects any leakage within its scope. Builders can use sensor measurements to better control the casting of concrete structures. Too fast a drying rate is a common problem, which causes concrete to shrink and

crack. Shrinkage and cracks weaken the strength of concrete.

- The CURE sensor measures the forces caused by capillarity. The results indicate whether the pore structure of concrete contains an adequate amount of water or whether the drying process should be slowed down.

Sensors also help monitor the impact of measures taken to slow down drying, such as the use of chemicals and plastic film. Based on the measurements, the software algorithm predicts when the concrete is dry enough for the next work phases to begin.

The sensors are mounted into the cast concrete, from where the results are wirelessly transmitted to the network. In this way, the measuring process does not interfere with work on the site.

- Good control of conditions helps ensure a successful casting and avoid costs from poor quality. This results in a strong and durable concrete structure, says Oikarinen.

## Measurements in cloud service

The sensors developed by Mato Engineering send measurement data to the cloud, using an IoT network based on Digita's LoRaWAN technology. LoRa is the world's first technology developed specifically for the Internet of Things.

Digita's IoT network covers nearly all of Finland. LoRa's benefits include good coverage and low power consumption.

Users can examine graphs and charts of the measurements on their mobile devices or computers. Depending on the frequency of measurement, the sensors' lifetime ranges from six months to ten years. In this time, they can perform approximately 20,000 measurements.

- The technology in the sensors is based on Finnish engineering competence. We are now looking for cooperation partners interested in developing business around these sensors and their patented technology.