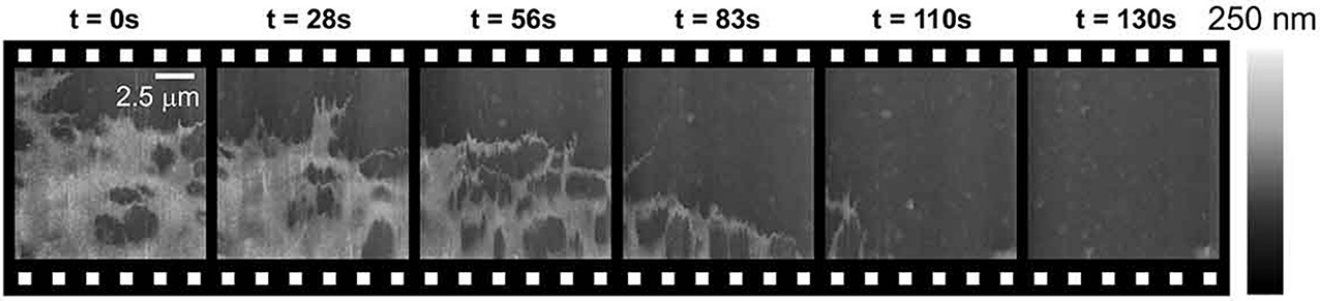
Scilight

23 December 2019

Speeding up scanning ion conductance microscopy without compromising resolution

Chris Patrick

Enhancing the ion current signal of SICM increases the efficiency of this technique, allowing researchers to image the dynamic behavior of nanostructures in fragile biological samples.



Scanning ion conductance microscopy (SICM) reveals the surface topography of samples without damaging them. This technique measures the current of ions flowing between the probe — an electrolyte-filled pipette — and an electrode in the bath surrounding the sample. When the pipette tip nears the sample surface, ion conductance around the tip changes. Researchers can look at this change in the ion conductance to image a sample's surface without direct physical contact.

But SICM imaging is slow. One image can take between a few minutes and a half hour to capture. This is not only inefficient, it's also too slow to image the dynamic behavior of a biological sample. Watanabe et al. developed high-speed SICM, increasing the imaging rate by a factor of 100 without compromising spatial resolution.

The authors increased the concentration of ions inside the probe, which created an ion concentration gradient at the tip of the probe and enhanced the signal of the ion current. The enhanced ion current signal improved the signal-to-noise ratio and increased the ion current detection bandwidth to 100 kilohertz, which permitted faster SICM measurements.

The researchers employed high-speed SICM to image fragile biological samples. They were easily able to capture the dynamic behavior of nanostructures forming on a living cell surface.

"Because such dynamics of the nanostructures are difficult to visualize without using our high-speed SICM at this moment, we can say the use of high-speed SICM increases the chances to capture phenomena occurring in living cell surfaces that no one has ever seen before," said author Shinji Watanabe. The authors will continue using high-speed SICM to better understand the dynamics of the nanostructures.

Source: "Development of high-speed ion conductance microscopy," by Shinji Watanabe, Satoko Kitazawa, Linhao Sun, Noriyuki Kodera, and Toshio Ando, *Review of Scientific Instruments* (2019). The article can be accessed at https://doi.org/10.1063/1.5118360.