MONASH University

MONASH INNOVATION

METHOD FOR MANUFACTURING SAMPLE HOLDERS FOR ELECTRON MICROSCOPY

Innovative techniques to produce sample holders that combine microfluidics with cryogenic transmission electron microscopy machines. The product reduces the effects of electron scattering, removes complicated manufacturing steps and creates consistency between samples.

- **Hermetically sealed sample holder**
- **Membrane <15nm thick to reduce electron scattering**
- **No formation of crystalline ice**

THE CHALLENGE

Transmission electron microscopy (TEM) sample holders are sometimes required to hold the sample in liquid form, replicating its natural state. This can be in conflict with the nature of a TEM machine, which requires a high or ultra-high vacuum for optimal performance.

Additionally sample holders need to be transparent to electrons, to reduce electron scattering. This is achieved by having ultra-thin windows (<15nm) through which the beam can be sent.

Currently sample holders with ultra-thin windows are made by one of two methods:

1. Fabricated in two halves and glued together to create a hermetic seal
2. Surface micromachining on a single die with sacrificial layers to generate enclosed chambers and channels.

Method 1 can be challenging to achieve and alignment is challenging. Method 2 is significantly more complex, but can introduce pillars and reduce bulging. It also almost eliminates misalignment.

Both methods are commercially inappropriate for producing windows of a minimum 50nm.

THE SOLUTION

The Monash research team has developed a method of producing a sample holder that incorporates layering of materials onto a substrate, and chemically etching the channels out. The result is shown in Figure 1.

The new design has an inlet on the left, a window and a plug. The top and bottom are joined at the center and bottom; this join restricts bowing of the sample holder, leading to more accurate measurements.

The window of the current invention can be as thin as 15nm or less, which is a significant improvement on the current technology.

Scanning electron microscope images of the fabricated environmental cell device with windows, release etch holes and plugs are shown in Figure 2.

Intellectual property: Australian provisional patent AU2018902312.

THE OPPORTUNITY

Monash seeks a partner to license this patented technology for further development and assist in bringing a practical application to the market.

The Monash Team behind this innovative technology is led by Assoc. Professor Alex de Marco, from the Monash Biomedicine Discovery Institute.

Reference: Nanofluidic and monolithic environmental cells for cryogenic microscopy. S. Gorelick *et al*, (2019) *Nanotechnology*. Feb; 30 085301

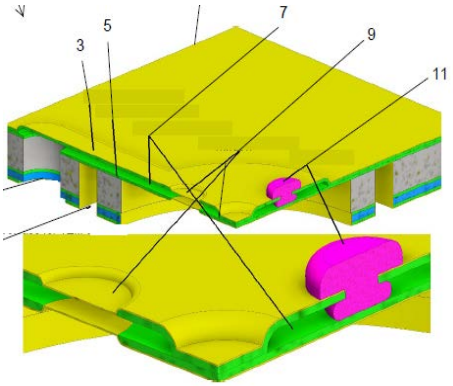

Figure 1. Schematic of the new sample holder.

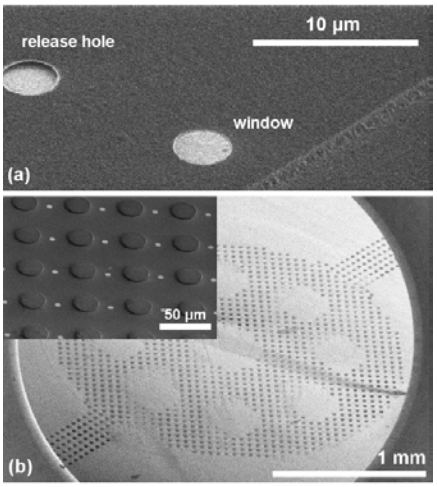

Figure 2. Scanning electron microscope images of the fabricated device.

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