Quality Control Method for a Micro-Nano-Channel Microfabricated Device

This method can be performed on multiple devices simultaneously or one at a time as quality control.

Lyndon B. Johnson Space Center, Houston, Texas

A variety of silicon-fabricated devices is used in medical applications such as drug and cell delivery, and DNA and protein separation and analysis. In applications such as drug delivery from implantable devices, the silicon device structure must have superior precision. In particular, the nano-channel size in implantable drug delivery membranes strongly determines the drug release from the implanted reservoir. An accidental difference in the nano size may translate into ineffective medical treatment or dangerous overdosing.

When a fluidic device inlet is connected to a compressed gas reservoir, and the outlet is at a lower pressure, a gas flow occurs through the membrane toward the outside. The method relies on the measurement of the gas pressure over the elapsed time inside the upstream and downstream environments. By knowing the volume of the upstream reservoir, the gas flow rate through the membrane over the pressure drop can be calculated.

This quality control method consists of measuring the gas flow through a device and comparing the results with a standard curve, which can be obtained by testing standard devices. Standard devices can be selected through a variety of techniques, both destructive and non-destructive, such as SEM, AFM, and standard particle filtration.

In this innovation, the method can be performed on multiple devices at once or one at a time as quality control for large-scale production. The testing device can be designed to perform the measurement testing in less than one minute. The testing gas can be chosen to not change or affect the surface properties of the devices, making it a non-destructive method. Also, the method can be performed during the production process, even inside a cleanroom on wafers or on final products as a conformity test. The testing system does not require expensive instruments, can be designed as a portable device, can be automated, and is flexible enough to be used on a variety of devices.

The system accuracy depends on the pressure sensor used. Commercially available pressure sensors allow building extremely high accuracy testing systems with high sensitivity and high reproducibility. Additionally, the system does not require specific expertise to be used.

This work was done by Alessandro Grattoni, Mauro Ferrari, and Xuewu Li of the University of Texas Health Science Center for Johnson Space Center. For further information, contact the Johnson Technology Transfer Office at (281) 483-3809.

Refer to MSC-24489-1, volume and number of this Medical Design Briefs *issue, and the page number.*