Xidex

Parallel Gas Injection System (PGIS) for Use with the NanoBot® Nanomanipulator

Overview

The Parallel Gas Injection System (PGIS) is offered as an option for use with Xidex's NanoBot® nanomanipulator. The PGIS accommodates up to four different gas precursors which are delivered via separate tubes and mix at the sample surface, as shown in the schematic, Figure 1. A library of LabVIEW™ based applications for gas deposition and etching as well as basic mechanical and electrical probing are installed on a laptop computer running Windows OS which is provided with the system. The LabVIEW™ based system also allows for user programming of custom applications.

The nanomanipulator based PGIS takes full advantage of the NanoBot's different operating modes for precise interaction with micro- and nano-scale objects. One or more additional NanoBot XYZ nanopositioners can be used to bring a mechanical or electrical probe, force sensor, gripper, or other end effector into close proximity or contact with the sample. The nanopositioners can be mounted on either the SEM/FIB stage or door assembly. Also, a nanomanipulator located inside the sample chamber can generally be made to have a larger range of motion than can a nanomanipulator suspended from a penetration in the wall of the sample chamber.

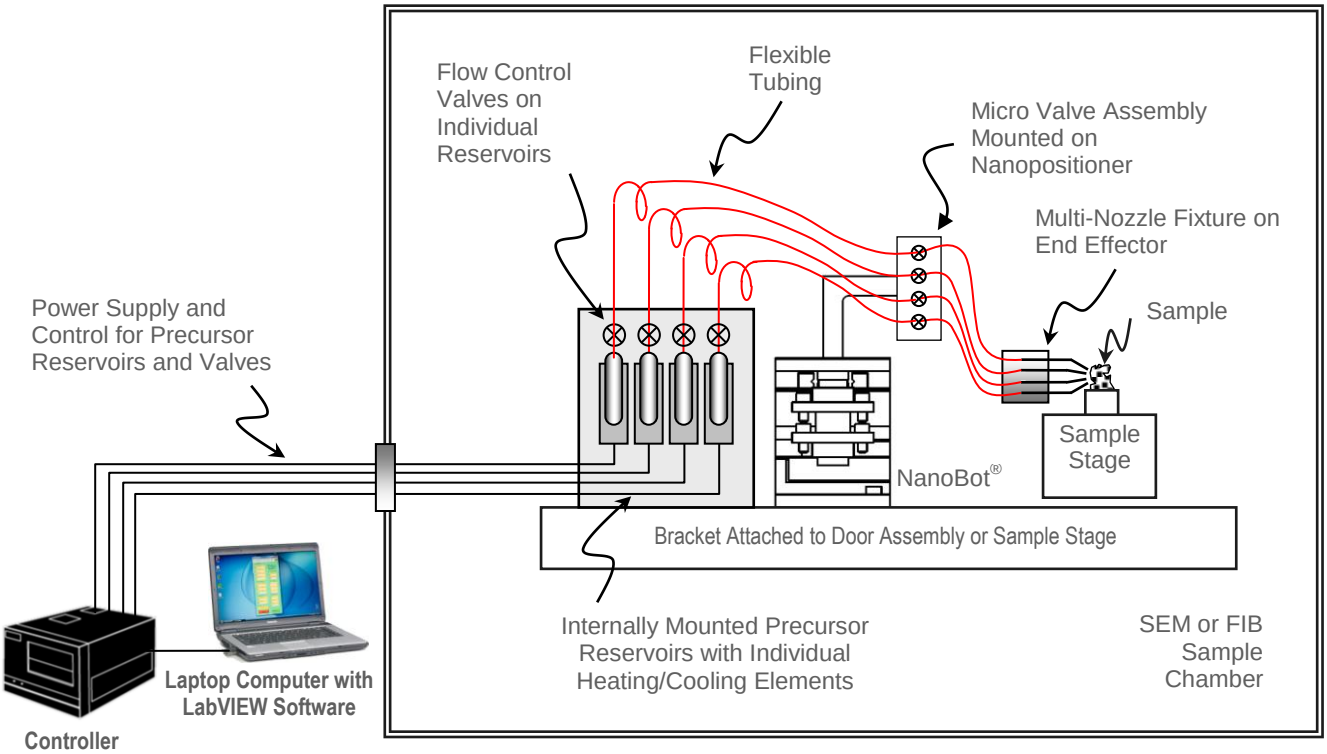

Figure 1 - Schematic of Xidex's Parallel Gas Injection System (PGIS)

Design Features

- Gas delivery nozzles (Figure 2) are attached to the NanoBot nanopositioner, which is located in-situ, within the SEM or FIB sample chamber.
- Up to four different gas precursors can be accommodated. Examples include platinum, tungsten, gold, TEOS, oxygen, xenon diflouride, and water vapor.
- Each gas travels through a separate tube and nozzle. A multi-nozzle fixture mounted on the nanopositioner enables precise positioning of a particular nozzle with respect to the substrate.
- Valves mounted on the nanopositioner enable fast on-off control of the gas flow within each individual nozzle.
- With multiple nanopositioners in the SEM or FIB tool, one nanomanipulator can carry the gas delivery nozzles while one or more additional nanopositioners can carry companion end-effectors, for nanodevice manipulation and testing.

Key Benefits

- The gas delivery nozzles can be moved in three orthogonal directions, providing access to all parts of the sample.
- The gas delivery nozzles can be positioned with respect to the sample surface at distances ranging from a few mm down to tens of µm.
- The ability to bring multiple gasses to the sample via separate delivery tubes makes it possible to simultaneously deliver different precursor gasses which have been selected so as to achieve competitive etching and deposition in a controlled manner.
- The ability to bring multiple gasses to the sample via separate delivery tubes precludes contamination from residual traces of a previously used process gas and reactions between incompatible gasses, as may be the case when multiple gasses share the same tubing and delivery nozzle.
- Availability of separate delivery tubes for each gas enables fast switching between multiple gasses without having to wait to purge the previous gas that was used.
- Operating the gas delivery nozzles with a nanomanipulator can result in optimized localized precursor pressure and flux at reduced chamber pressures.

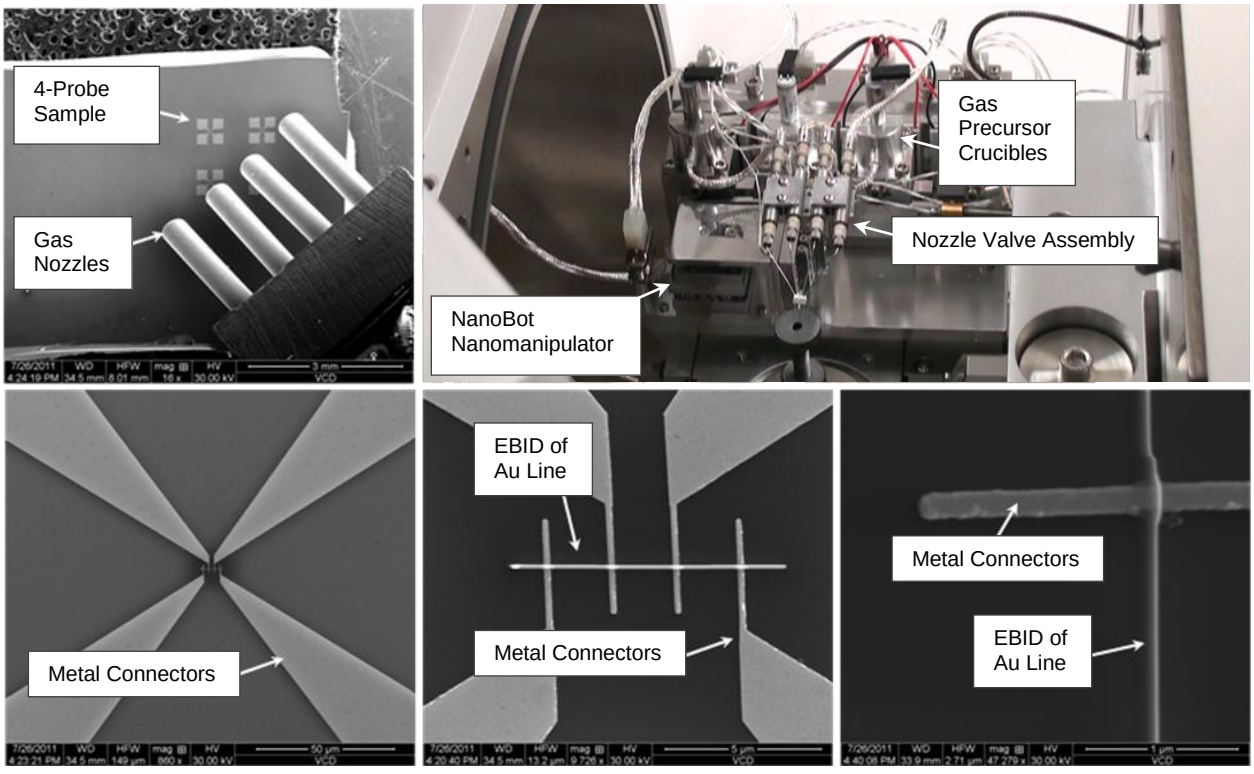

Figure 2 - Parallel Gas Injection System (PGIS) with Au Deposition Example

Nanodevice Fabrication

The PGIS makes it possible to custom fabricate nanodevices for a variety of applications in industry and academia. Figure 3 (left) shows a Pt nanotip fabricated on a sharp Si tip using the PGIS. A Pt nanotip of this kind can be used for high resolution electrical measurements with a scanning probe tool.

Figure 3 (right) shows an example in which a Pt nanotip has been fabricated at the apex of a sharp W probe using the PGIS. A Pt nanotip of this kind is suitable for field emission experiments in which the diameter and aspect ratio of the tip play an important role.

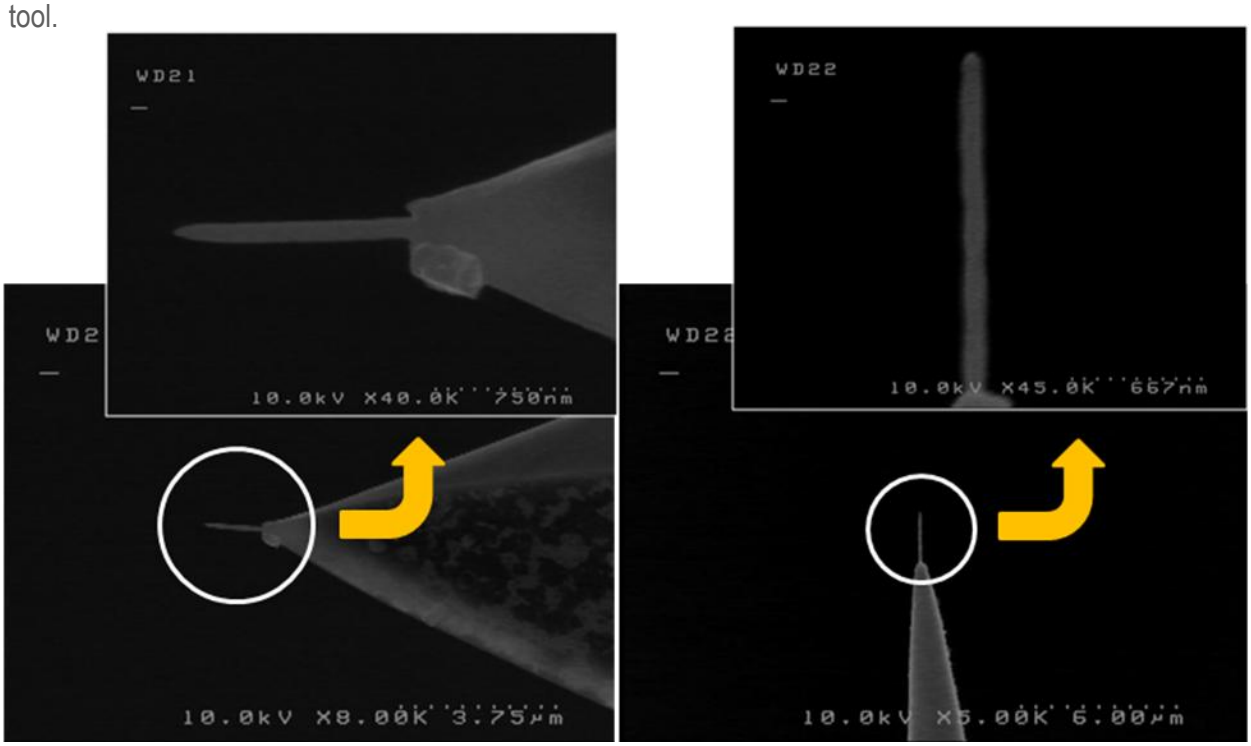

Figure 3 – (Left) Electron beam induced deposition of a Pt scanning probe tip on a sharp Si tip. (Right) Electron beam induced deposition of a Pt field emitter tip on a sharp W probe.

LabVIEW Based Control

The LabVIEW™ based applications library provided with the PGIS enables basic deposition and etching operations, including selection of process gasses, programming of process gas flow rates and management of reservoir temperature (Figure 4). Since the NanoBot itself is also LabVIEW™ based, PGIS operations can be seamlessly integrated with XYZ navigation and positioning and other NanoBot applications. In addition, the user has the option of creating custom applications which can then be added to the applications library.

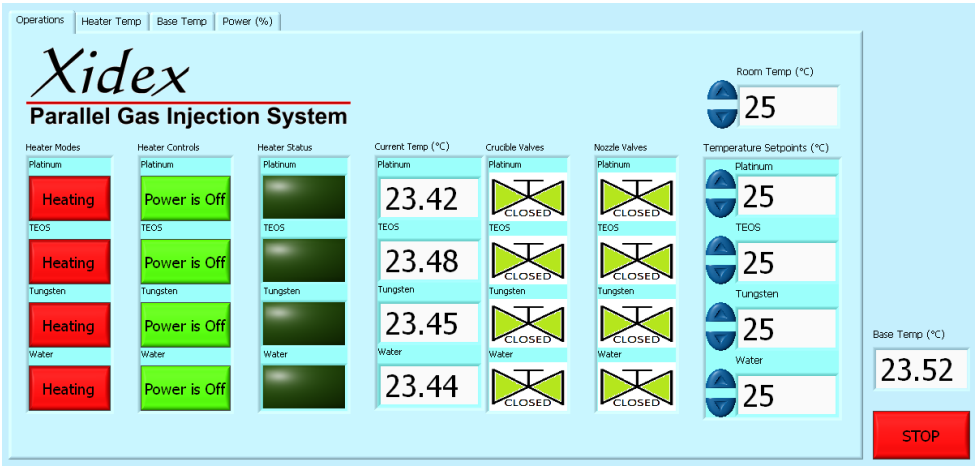

Figure 4 – PGIS User Interface.

Xidex Corporation

Xidex manufactures and sells the NanoBot system, an easy-to-use, highly versatile, user-programmable nanomanipulator built for use inside scanning electron microscopes (SEMs) and focused ion beam (FIB) tools. The NanoBot system transforms a SEM or FIB into a workshop for nanodevice fabrication and testing.

Xidex Corporation was founded in 1997 as an Austin-based Texas Corporation by Dr. Vladimir Mancevski, President and Chief Technology Officer, and Dr. Paul F. McClure, CEO.

Contacts

For sales inquiries contact:

Ray Eby, PhD
NanoBioSystems, Inc.
phone: 312-545-6527
e-mail: nanoray@sbcglobal.net

For other inquiries, contact:

Xidex Corporation
8906 Wall Street, Suite 703
Austin, Texas 78754
phone: 512-339-0608
fax: 512-339-9497
e-mail: info@xidex.com
web: www.xidex.com

110913

Xidex

NANODEVICES AT WORK