Available for Licensing

Wall-Mounted QCM Fixture for Atomic Layer Deposition

Novel fixture increases film measurement accuracy

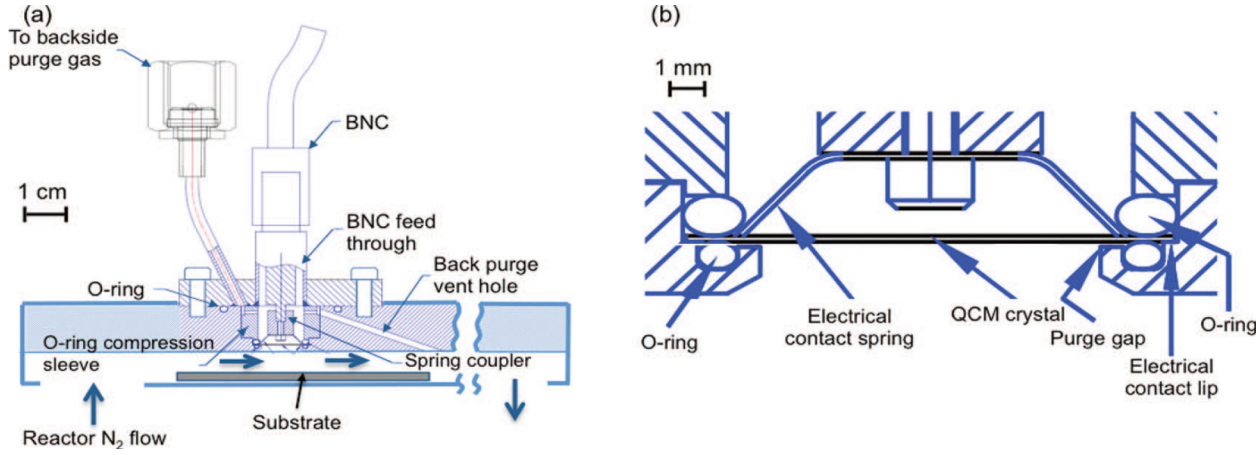
The Invention

Quartz crystal microbalance (QCM) measurements have played a vital role in understanding and expediting new atomic layer deposition (ALD) processes. QCMs are routinely employed in conventional vacuum deposition processes where *in situ* thickness measurements are valuable, for example, in thermal evaporation. More recently, QCM measurements have emerged as a powerful, *in situ* method for determination of ALD growth rates and nucleation phenomena, optimizing processing conditions, and elucidating surface reaction mechanisms.

However, significant barriers remain to routine QCM use and accurate execution. Obtaining accurate mass measurements during ALD is difficult because

- Temperature fluctuations can cause artifacts, and QCM is intended to be performed at room temperature only, and
- ALD is not a line-of-sight deposition method so may cause deposition on both quartz crystal faces.

In order to overcome these challenges and turn this exclusively *in situ* technique into a routine characterization method, Argonne has developed an integral QCM fixture. This new design is easily implemented on a variety of chemical vapor deposition (CVD) tools and has a number of benefits. Unlike previous QCM designs, the fast thermal equilibration of Argonne's invention enables tasks such as temperature-dependent studies and *ex situ* sample exchange, further highlighting the utility of this QCM design for day-to-day use.



Schematic of integral QCM fixture

Benefits

- Easily implemented on a variety of chemical vapor deposition tools – can be retrofitted to existing reactors to add accurate film measurement capabilities for little cost
- Allows rapid sample exchange
- Prevents backside deposition
- Minimizes flow disturbance
- Wall mounted – inexpensive to do and does not interfere with gas flow in the reactor
- Simple crystal exchange – conserves time and allows maximum use of reactor
- Rapid thermal equilibration – little waiting for reactor to heat up
- Multiple crystal capability – added reliability and spatial mapping of film growth

Applications and Industries

- Atomic layer deposition
- Semiconductor microelectronics industry
- Renewable energy technologies
- Batteries
- Catalysis
- Filtration

Developmental Stage

Proof of concept

Availability/Commercial Readiness

Available for commercialization

Argonne Invention Number

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Intellectual Property

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