Colnatec RC™ Quartz Crystals

The World's Most Advanced Film Thickness Sensors

Superior Replacement Quartz Crystals for Precision Film Thickness Monitoring

The measurement of film thickness during a vacuum deposition process can be accomplished with great accuracy and precision using a quartz crystal microbalance, or QCM. Under controlled conditions, it is possible to achieve Angstrom level resolution of the film thickness. In practice, however, this is rarely achieved.

A film thickness monitor measures the change in resonance frequency of an oscillating quartz crystal while a thin film coating is collecting on its surface. As the coating builds up the resonance frequency decreases in a very predictable fashion. If the density of the deposited film is known, the thickness of the film can be calculated in real-time.

A film thickness monitor works on the underlying assumption that any change in the resonance frequency is solely a result of film build-up. Unfortunately, quartz crystals can also change resonance frequency when exposed to a thermal gradient or mechanical stress. In a typical thin film deposition, both of these phenomena exist due to either the deposition source radiation, highly energetic species (as in sputtering) or stresses caused by film condensation. Often these factors exist in concert.

For ultra-thin film thickness measurements, in the 10 to 100 Angstrom range, a combination of frequency shifts caused by heat, stress and film build-up can lead to thickness errors of 100% or more. As a result, the vacuum process becomes uncontrollable. A new quartz crystal has been developed that mitigates these factors. Called the RC crystal, this recently patented design is insensitive to frequency shifts caused by source radiation or film stress. This is accomplished by adjusting the stress coeffcients of the quartz plate using advanced fabrication methods.

The RC crystal will not show a rate spike when the deposition source shutter is opened. Typically, this action causes a frequency shift of up to 100 Hz, which translates for films such as aluminum, to rate changes of 50 Angstroms. Further, the noise associated with the intense energy of impinging atoms in sputtering is dramatically reduced, owing to the stress insensitivity of the crystal. These are very real advantages in the measurement of nanometer films used in the manufacture of OLED's, precision optical interference films, or next generation electronic devices.

RC crystals can be used in place of standard AT-cut quartz in all commercially available film thickness monitors and controllers. They are only 6 MHz versions, with gold, silver or aluminum electrodes, currently sized in 14 mm (0.550") and 12.5mm (0.490") diameters, but 8.6mm will be available shortly for use in our 24-crystal sensor head, Infinity™. [US Patent No. 6,820,485 B2]

Inficon™ Type RC Crystals

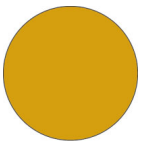
CNT06RCIG: Gold
CNT06RCIA: Aluminum
CNT06RCIS: Silver

Frequency: 5.975-5.993 MHz
Resistance: < 40 Ohm
Finish: 7 microns RMS
Diameter: 14mm
Contour: Plano-Convex
Cut: RC cut +/-1'

Balzers™ Type RC Crystals

CNT05RCBG: Gold
CNT05RCBA: Aluminum
CNT05RCBS: Silver

Frequency: 4.960-4.975 MHz
Resistance: < 40 Ohm
Finish: 7 microns RMS
Diameter: 14mm
Contour: Plano-Convex
Cut: RC cut +/-1'



Ulvac™ Type RC Crystals

CNT05RCSG: Gold
CNT05RCSA: Aluminum
CNT05RCSS: Silver

Frequency: 4.990-5.000 MHz
Resistance: < 40 Ohm
Finish: 7 microns RMS
Diameter: 12.5mm
Contour: Plano-Convex
Cut: RC cut +/-1'

Colnatec™ Type RC Crystals

CNT86RCCG: Gold
CNT86RCCA: Aluminum
CNT86RCCS: Silver

Frequency: 5.975-5.993 MHz
Resistance: < 40 Ohm
Finish: 7 microns RMS
Diameter: 8.6mm
Contour: Plano-Convex
Cut: RC cut +/-1'

All crystals packaged 10 pieces per disk

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