Development of Second Generation Compact System for In-situ X-ray Scattering Studies of Organic Thin Film Deposition

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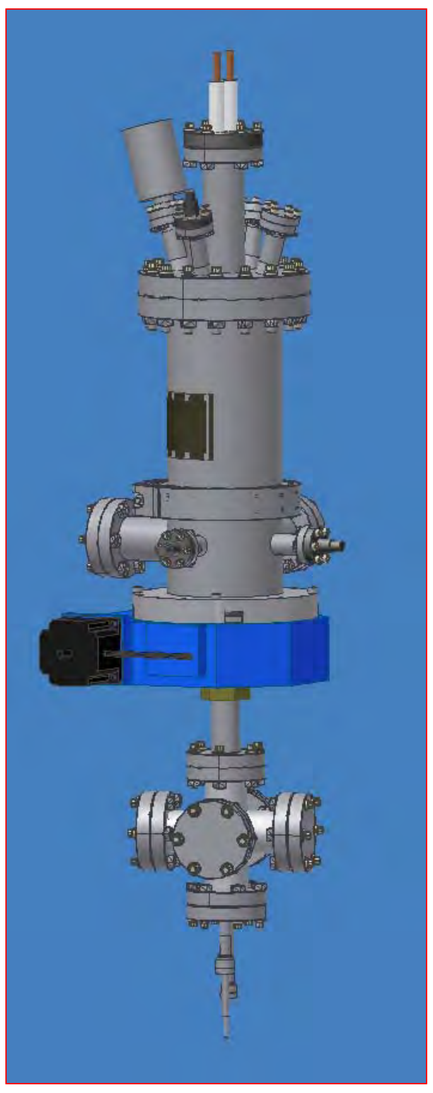
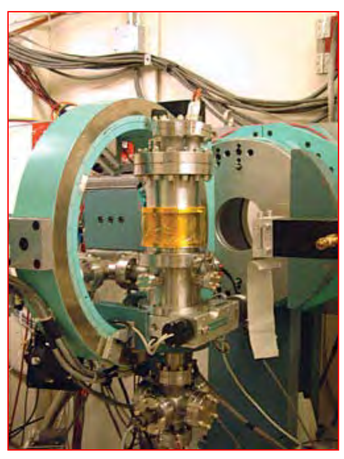
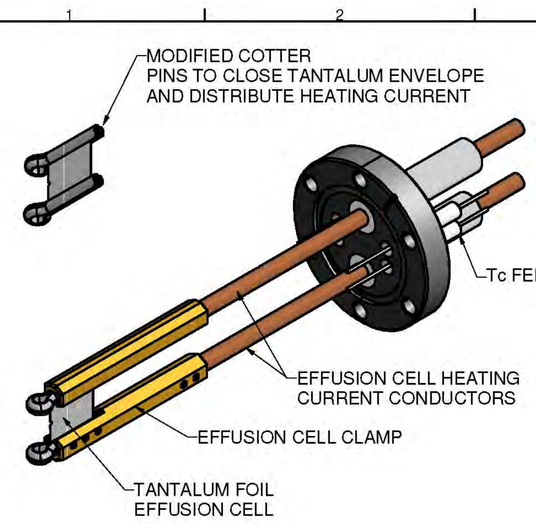
This system is a second generation compact vacuum deposition chamber for in-situ x-ray scattering studies of organic thin film growth. The system is based on a small cylindrical chamber that can be mounted on a standard four-circle diffractometer. There are a number of upgrades made in this latest design, making the system more reliable, user friendly and precise. Incident and scattered x-rays enter and exit the chamber through a curved Befoil window that covers 200 degrees, and is sealed to the body of the chamber. The sample is mounted on a support tube with heating and cooling from >100°C to liquid nitrogen temperature. Integral to the sample stage is a multi-wire feedthrough to facilitate in-situ electrical transport characterization of organic semiconductor thin films. This is one of the novel capabilities of the system. In addition, the sample stage is mounted on a rotary vacuum feedthrough, which is mechanically coupled to the “phi” stage of the diffractometer. An effusion cell, shutter, and quartz oscillator thickness monitor are also incorporated into the system, which is pumped by a small turbomolecular pump.

TABLE 1. Design Specifications
Sample heating to 200 C
Sample cooling to -173 C
3 isolated electrical corrections on sample mount
Compatible for .5mm or 1.5mm thick samples
Sample mounting plate perpendicular to rotation axis within .1 degree
Sample motion/runout less than .010"
Only molybdenum parts in contact with sample
Compatible with 512 Eulerian cradle

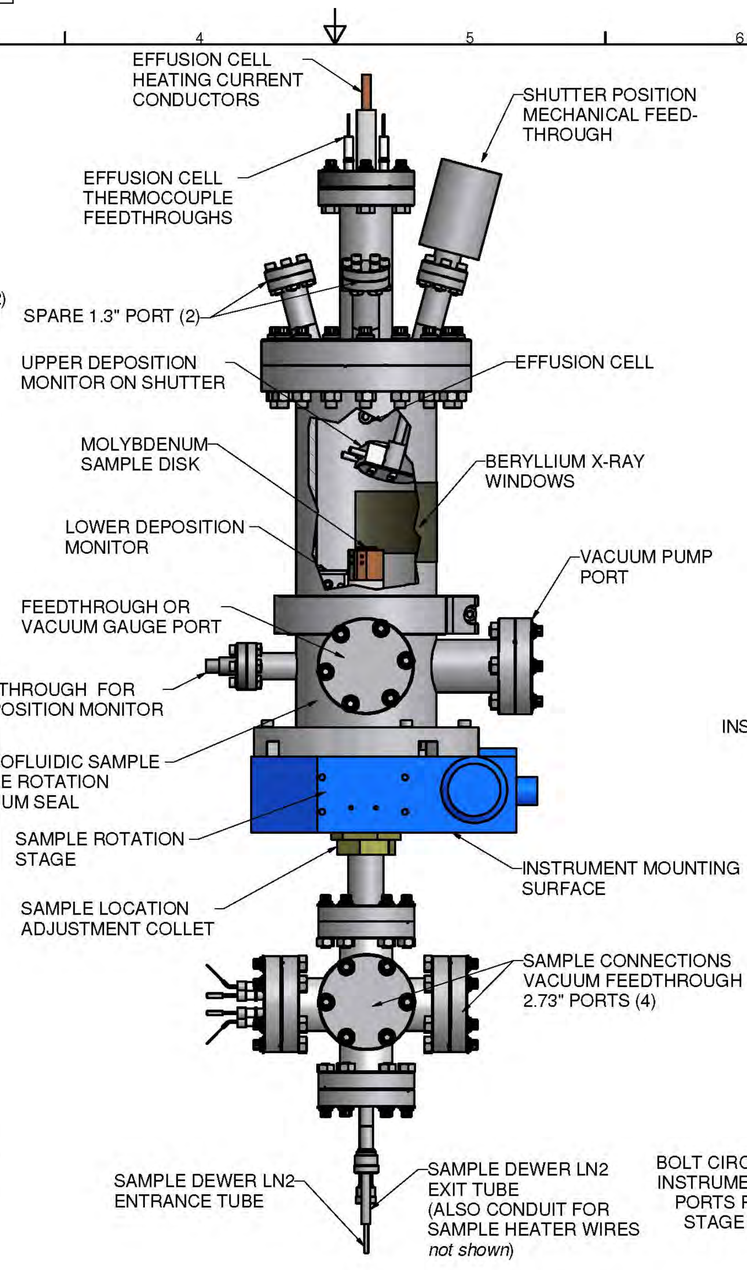




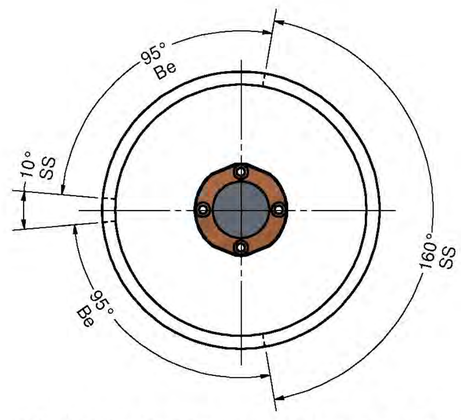
The Pentacene Film Growth Instrument is composed of several subsystems that work in concert to facilitate the study of the film growth and properties.
Figure 1
The top of the system, as shown in Figure 1, is dedicated to the effusion cell and the control of the thermal effusion process. The 6” conflat flange that caps the vacuum chamber has a central 38 mm [1.5”] port that can be equipped with either a Knudsen cell or a simple tantalum envelope that is resistance heated by DC current applied to a medium current feedthrough. The current feedthrough also incorporates a pair of thermocouple feedthroughs to facilitate the temperature control of the tantalum envelope, to more closely control the effusion process. The top flange also carries a mechanical feedthrough that actuates a mechanical shutter equipped with a quartz crystal deposition monitor. The shutter allows the effusion process to be monitored and brought up to a desirable operating condition before clearing a path for controlled deposition on the sample stage. Two additional 19 mm [.75”] ports are provided that can be used for a camera and lighting or any additional instrumentation.



EFFUSION CELL ASSEMBLY



COMPLETE ASSEMBLY



X-RAY Be WINDOW ANGULAR DIMENSIONS

WINDOWS ARE 44.5mm [1.75'] HIGH
WINDOW CLOCKING TO BASE INFINITELY ADJUSTABLE

SAMPLE TUBE

TOP VIEW CHAMBER BOTTOM

First Angle Projection All dimensions are mm [in] inch dimensions are reference		Drawing Standard: ANSI Y14.5M-1994	Date
Material	Protective Finish	Drawn by J. Thompson	8/30/2009
	None	Eng approval J. Thompson	8/30/2009
		Mfg approval	
		Assy approval	
Purchased Part Modification: No		UNLESS OTHERWISE SPECIFIED All Dimensions BASIC N7 machined surfaces 0,13 0,38 0,25 A B C 0,25 A B C	Part Number 00015595
Advanced Design Consulting USA, Inc. 126 Ridge Road / PO Box 187 Lansing, NY 14882 Phone: 607.533.3531 / Fax: 607.533.3618 E-mail: adc@adc9001.com / Web: www.adc9001.com		Top Assembly-Pentacene Film Instrument	Revision / Size A2 / Sheet 4 / 4

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