PORT PLASTICS

Semiconductor

KEEP THAT CHAMBER CLEAN!

Outgassing of Common Plastic Materials for Semiconductor

Many of the process tools used in the manufacture of IC chips perform their critical steps within vacuum chambers. Given the current chip technology being sub 7 nanometer, clean materials are becoming more and more critical. One such measure of cleanliness is outgassing. Outgassing is the release of trapped gas within the plastic often created in the manufacture and processing of the plastic materials. Within the substrate there exists micro porosity, the micro porosity provides a potential for trapping water vapor, oils, solvents and organic volatile materials. The best way to reduce outgassing is to start with raw materials that have a higher level of purity to begin with. Outgassed impurities can condense on the sensitive components such as lenses or electronics or even find their way onto the wafer.

One such common method for the measure for outgassing follows the ASTM E595 test method. ASTM E595 provides three separate measurements, Total Mass Loss (TML %), Collected Volatile Condensable Materials (CVCM %) and Water Vapor Regained (WVR %). The test calls out for the plastic to be exposed for 24 hours to a vacuum of 5 x 10^{-5} Torr @ 257°F.

The three values give a complete picture of the materials performance in terms of basic outgassing. The TML records the plastic substrates loss of total mass after the test protocol is completed. Collected Volatile Condensable Materials (CVCM) then measures the amount of material that was collected via condensation. This is important because this reflects the most dangerous volatiles that can collect on the surface of the critical components within the chamber. The third measurement is Water Vapor Regained which simply measures the moisture regained in the substrate after 24 hours at room temperature (73.4°F) @ 50% relative humidity. Often in semiconductor or electronics applications, this value is of least importance because the plastic part performs in a controlled environment. The difference between TML and WVR is assumed to be the volatile organic content of which the CVCM is the condensable portion of that content. The closer the TML value is to the WVR the cleaner the plastic material.

This table shows some values for common materials associated with Semiconductor & Electronics manufacturing, if you have questions about materials as they relate to vacuum chamber applications, feel free to contact your local Port Plastics sales office or visit **PORTPLASTICS.COM**

Material	TML %	CVCM %	WVR %
Delrin® Acetal	0.28	0.02	0.13
Celazole® PBI	2.51	0.00	0.39
Polyimide (Standard)	1.09	0.00	0.40
PET-P (Standard)	0.26	0.00	0.08
PEEK (Victrex)	0.26	0.00	0.12
Nylon (Standard)	1.19	0.00	0.36
Polysulphone	0.40	0.01	0.36
PPS (Techtron®)	0.04	0.00	0.00
UHMW-PE	0.06	0.00	0.00
PAI (Torlon®)	1.85	0.00	0.49
PEI (Ultem®)	0.40	0.00	0.16
PTFE (Teflon®)	0.05	0.00	0.02

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