

Vacuum Sealing, Mounting and Etching Waxes

January 2018

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Introduction

Apiezon waxes are versatile products offering a multitude of uses. The key applications and features of the products are shown in the table opposite.

Vacuum sealing

Apiezon waxes are ideal for use where a rigid permanent or semi-permanent sealed joint is required.

Apiezon waxes are equally effective at maintaining seals in vacuum systems down to 10^{-9} torr at 20°C (dependent on the wax) and in systems at small positive pressures. They are excellent waterproof mediums providing a total seal against liquid water and offer superior sealing against water vapour and atmospheric moisture.

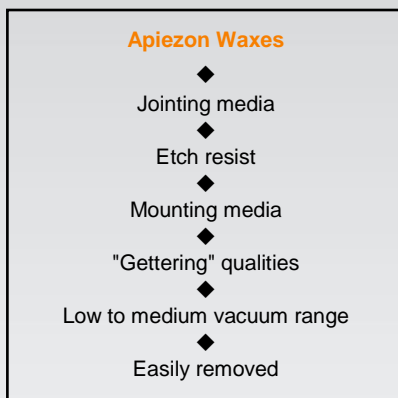
The excellent vapour pressure characteristics, as shown in the graph opposite, are extremely important for a variety of applications, including thin film deposition. Volatiles will not jeopardise the vacuum within the system or contaminate thin film deposits.

Etch resist

Apiezon waxes are used in the manufacture of silicon transistors and integrated circuits.

They are chemically inert, being resistant to etching fluids such as:-

- ▶ HF (Hydrofluoric acid)
- ▶ HNO₃ (Nitric acid)
- ▶ CH₃COOH (Acetic acid)
- ▶ KOH (Potassium hydroxide)
- ▶ TMAH (Tetramethylammonium Hydroxide)
- ▶ EDP (Ethylenediamine pyrocatechol)
- ▶ NaOH (Sodium hydroxide)



Apiezon waxes are extensively used as protective coatings for printed circuits, ensuring complete protection for the copper circuit from acid etching oxidation, while enabling direct soldering through the wax.

Mounting media

Apiezon waxes are excellent mounting media and are used extensively as both temporary and permanent adhesives for the mounting of silicon chips.

"Gettering" action

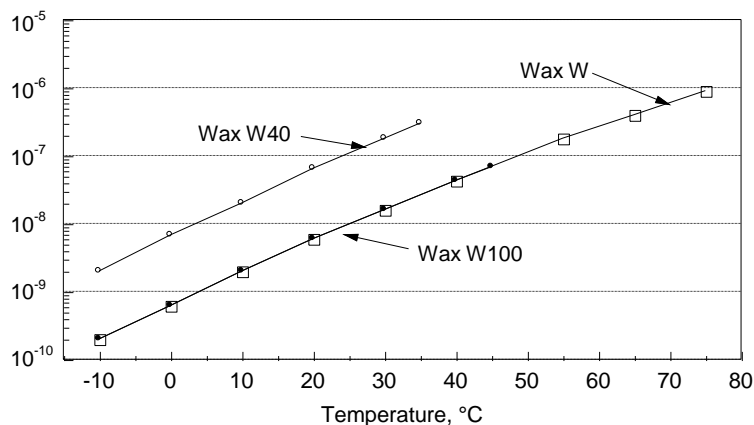
Like the greases, Apiezon waxes contain a high proportion of branched and unsaturated hydrocarbons. These complex structures give Apiezon waxes a very high molecular weight and consequently strong powers of absorption, particularly for other hydrocarbon molecules.

Strong absorption properties ensure that Apiezon waxes have a powerful "gettering" action, i.e. the power to absorb greasy or chemical impurities on metal and glass surfaces.

Apiezon waxes have no contaminating effect on electrical equipment and are easily removed by hydrocarbon solvents, taking with it many trace impurities which are not removed by solvents alone. This has led to their extensive use in the electronics industry, where scrupulous cleanliness of metal surfaces is required.

Vapour pressure over working temperature range

Vapour Pressure, Torr



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How to use

Apply pre-melted wax to the required area using a glass rod, spatula or other similar implement, taking care not to exceed 60°C above the softening point of the wax shown in the table opposite.

Alternatively dissolve the wax in a hydrocarbon solvent prior to use. Evaporation of the solvent will leave a thin layer of wax with excellent adhesive properties. To ensure an adhesive layer of uniform thickness, rapidly rotate the chip and a superior mounting surface will be created.

Easily removed

To remove the wax after use, simply heat, soften and scrape away larger amounts. Any deposits can then be dissolved away by using any aromatic hydrocarbon solvent (toluene, xylene) or removed using a vapour degreasing bath.

Apiezon waxes are not soluble in alcohols (ethanol, IPA) or ketones (acetone, MEK) so these cannot be used for cleaning.

First choice

Apiezon Wax W is the first choice wax for most situations, offering efficient joint sealing over the widest temperature range, the most resistance to attack by acids and alkalis, the lowest vapour pressures, the most resistance to water and, for such a versatile wax, surprisingly the lowest cost when presented in the 1kg block.

Wax W is also available in stick form offering fast and convenient application. A single stick can simply be heated at the site of application with a small blow torch or Bunsen burner.

Typical Properties

<i>Physical property</i>		Wax W	W100	W40
<i>Approximate softening point</i>	°C	80 to 90	50 to 60	40 to 50
	°F	176 to 194	122 to 140	104 to 122
<i>Est. vapour pressure @ 20°C / 68°F, Torr</i>		4.5 x 10 ⁻⁹	4.5 x 10 ⁻⁹	6 x 10 ⁻⁸
<i>Temp for application</i>	°C	130	110	90
	°F	266	230	194
<i>Working temperature range</i>	°C	-10 to 75	-10 to 45	-10 to 35
	°F	14 to 168	14 to 113	14 to 95
<i>Water permeability</i>		1.4 x 10 ⁻⁸	1.6 x 10 ⁻⁸	1.6 x 10 ⁻⁸
<i>g/cm/hr/mm Hg @ 25°C</i>				
<i>Pack</i>		500g* 1kg block	250g tin	250g tin
<i>Thermal/Electrical property</i>				
<i>Thermal conductivity @ 20°C, W/m°C</i>		0.189	0.170	0.177
<i>Specific heat @ 25°C, J/g</i>		1.8	2.7	2.9
<i>Loss tangent</i>		0.015	0.016	0.015
<i>Permittivity</i>		2.8	2.7	2.9
<i>Volume resistivity, Ω cm</i>		6.31 x 10 ¹⁵	1.64 x 10 ¹⁵	5.06 x 10 ¹⁵

*500g pack contains a minimum of 25 sticks each of approximately 20g

Greater choice

The Apiezon range offers the choice of three waxes with differing properties depending on the specific requirements of the job in hand. In addition to Wax W, two other formulations are available.

Wax W100 is a medium hardness vacuum sealing and mounting wax. It is inherently softer than Wax W, thus reducing the risk of cracking glass joints if they are subject to vibration.

Wax W40 is the softest of all the Apiezon waxes. With a softening point of just 40 to 50°C, it can be prepared for use in hot water for application to heat sensitive joints.

Shelf life

The shelf life of the Apiezon waxes is ten years from date of manufacture, providing the product is in the original unopened packaging and has been stored at ambient (10 to 30°C) temperature.