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## Shelf Life and Storage

### HD Microsystems™ Polyimide Materials

HD Microsystems (HDM) offers a complete product line of polyimide coatings for microelectronic, quartz fiber and various other commercial applications. These coatings have been formulated as a polyimide precursor in solvent carriers. After application the polyimide precursor is thermally cured into an inert, resilient, aromatic polyimide film. This curing process is called imidization.

All HDM products must be protected from high temperatures ( $>40^{\circ}\text{C}$ ) before application. They are shipped in insulated containers with cold packs, dry ice or eutectic plates to keep the product chilled, not necessarily frozen, during shipment. Upon receipt, these products should be immediately placed in cold storage.

Some HDM products are photodefinable (or self-imaging). Photodefinable polyimides can be photographically patterned prior to cure when exposed to UV light using common photo masks and lithography tools. Prior to application, care should be taken to avoid exposing these coatings to white light to prevent photo-initiated cross-linking.

Product shelf life is the period of time a given polyimide product is expected to stay within the limits of its respective HDM product specification. Polyimide shelf life will vary based on the polymeric composition (product series), solids content and viscosity. Improper storage or environmental conditions during transit can impact the shelf life, processibility, and/or cured film properties of the polyimide coatings.

#### Cold Storage Shelf Life

Cold storage of HD Microsystems polyimides will greatly increase their working life. The recommended cold storage temperature for most HD Microsystems polyimide products is  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ), freezer temperature, within the range of  $-10^{\circ}\text{C}$  to  $-20^{\circ}\text{C}$ . Long term storage temperatures below  $-20^{\circ}\text{C}$  may be detrimental.

PIQ and PIX series polyimides *should not* be stored frozen (although they are packed in dry ice for short-term shipment). These products should be refrigerated upon receipt at a temperature of  $7^{\circ}\text{C}$  ( $45^{\circ}\text{F}$ ) within the range of  $1^{\circ}\text{C}$  to  $8^{\circ}\text{C}$ .

The cold storage shelf life for various HDM products is listed in Table 1 and is based on the date of manufacture. Products will not be shipped without the lesser of six months or 50% of their remaining cold storage shelf life.

### **Room Temperature Shelf Life**

Room temperature shelf life for various HD MicroSystems polyimides is also detailed in Table 1. This shelf life assumes a production floor temperature of around 21°C and that the relative humidity is controlled to about 30-45%.

Room temperature shelf life can be thought of as a clock. The clock is stopped while the bottle is in the freezer. When taken out and warmed, it starts running. If returned to the freezer, the clock will stop and remained stopped until the bottle is warmed again. The room temperature shelf life is cumulative over the time the bottle is at room temperature.

### **Protect From Humidity**

Polyimide formulations are hygroscopic in nature due to the solvent carrier system. Absorbed water can lower the viscosity and degrade coating quality of the polyimide solution. Open containers of polyimide that remain out in the fab or production area for more than 12 hours should be protected from the open air to prevent moisture absorption. This applies both to open bottles used for hand pouring or in pump systems. Standard polyimides may be blanketed with nitrogen or clean dry air. Photodefinable polyimides should use only clean dry air.

Frozen or refrigerated containers of polyimide should not be opened until the bottle is allowed to properly warm up to room temperature to prevent moisture condensation on the inside of the bottle. HDM recommends waiting at least 3 hours for a 250g bottle, 8 hours for a 1Kg bottle and 16 hours for a 4Kg bottle.

Bottles may be recapped after use and returned to the freezer. Care should be taken that particles are not generated by the polyimide remaining on the bottle neck threads. Material can dry out and flake off upon reopening, contaminating the material in the bottle. Wipe the threads clean with a lint free wipe before recapping.

### **Shipping Temperatures**

Cold storage temperatures are required for long term storage but are not necessary for shipping. Polyimide and PBO materials are stored at low temperatures to slow any naturally occurring chemical reactions that would change the material's properties. This is done to keep the lot as uniform as possible so the last bottle processes exactly like the first bottle.

When shipping these products, air transportation is used and they arrive within a few days. It is not critical to keep the HDM materials at the same cold storage temperatures for these few days but it is important to protect them from high temperature excursions. If these materials, especially photosensitive materials, are exposed to heat, the polymerization process can start, dramatically altering the viscosity and photo properties.

Since the conditions the shipment may experience during transportation are unknown (for example, left in the sun on the tarmac at the airport), dry ice or chemical ice packs are placed in the carton to help control the maximum temperature. Shipping conditions could thus range from -68 °C (dry ice temperature) to room temperature. If the delivery is delayed and the box warms, the material is not ruined unless exposed to high temperatures. Warming to room temperature during the shipment will simply decrease the available room temperature shelf life (see room temperature shelf life above).

Upon arrival, the materials should be placed in to cold storage until needed.

### Ancillary Products

HDM Ancillary Products should be stored at room temperature (20°C to 30°C) in a dry area - certified as safe for the storage of these products. All of these products (except VM-652) have a two-year shelf life when stored unopened under these conditions. Refrigeration or freezing is unnecessary and not recommended.

All Ancillary Products, particularly VM-651 adhesion promoter concentrate, should be tightly recapped and protected from humidity when stored after opening.

VM-652 is a pre-mixed, ready-to-use, solvent based, adhesion promoter and should be used within 6 months of the date of manufacture.

**Table 1. Shelf Life of HD MicroSystems Products**

<b>Product Code or Series</b>	<b>Shelf Life</b>	
	<i>RT</i>	<i>Cold Storage</i>
<b>Standard Polyimides</b>		
PI-2545	2 weeks	24 months
PI-2525/2555/2556	3 weeks	24 months
PI-2562	3 weeks	24 months
PI-2574	1 week	12 months
PI-2610/2611	2 weeks	24 months
PI-2808	2 weeks	24 months
PI-5878G	2 weeks	24 months
PIQ Series	2-3 days	6 months
PIX Series	2-3 days	6 months
<b>Photodefinable Polyimides</b>		
PI-2720 Series	6 weeks	24 months
PI-2730 Series	2 weeks	12 months
PI-2771	6 weeks	24 months
HD-4000 Series	4 weeks	24 months
HD-4100 Series	4 weeks	24 months
HD-7000 Series	4 weeks	24 months
HD-8000 Series	2 weeks	6 months
HD-8800 Series	2 weeks	12 months
HD-8900 Series	2 weeks	6 months

For more information about HD MicroSystems polyimide, PBO or ancillary products, please review the associated Product Bulletin, MSDS or consult with your HD MicroSystems™ Technical Representative.

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**Caution:** Do not use in medical applications involving permanent implantation in the human body.