

Polyimide Thinning Processing

Standard Operating Procedure

Faculty Supervisor: Prof. Robert White, Mechanical Engineering (x72210)

**Safety Office: Peter Nowak x73246 (Just dial this directly on any campus phone.)
(617)627-3246 (From off-campus or from a cell phone)**

Tufts Emergency Medical Services are at x66911.

Revised: November 12, 2009

Goal:

To reduce viscosity of spin-on polyimide solution to produce desired film thickness.

Warnings:

The chemicals you are working with are not acutely hazardous. But it can cause skin and eye irritation. Avoid inhalation of the product. T-9039 and the polyimide itself are flammable.

1. Material Requirements:

1.1 Equipment and tools: Small amber glass bottle, scale

1.2 Chemicals: T-9039 thinner (Propylene Glycol Monomethyl Ether; N-Methyl-2-Pyrrolidone), HD-4100 series photodefineable polyimide,

1.2.1 Hazards associated with chemicals:

1.2.1.1 T-9039 thinner: minor skin, eye and respiratory irritant.
Flammable with a flashpoint of 130F.

1.2.1.2 HD-4100 series polyimide: minor skin, eye and respiratory irritant. Somewhat flammable.

1.3 Engineering Controls: Conduct procedures in the fume hood. Dispose of chemicals as described at the end of this document.

1.4 Personal Protective Equipment: Nitrile gloves and eye protection required for all procedures.

2.0 Procedure:

2.1 A small working quantity of polyimide should be transferred to an amber bottle for processing. The polyimide is kept in the freezer; you need to let it warm to room temperature, then pour a working quantity into a clean amber bottle for your use. The polyimide stock bottle should be returned to the freezer. The polyimide can be kept in the amber bottle at room temperature for about a month before properties will start to degrade.

2.2 Add some T-9039 thinner in the amber bottle using a pipette. Mix the thinner with polyimide by inverting the bottle top to bottom and bottom to top until everything looks uniform. Do not shake the bottle but just gently invert it. Dramatic movement will induce bubbles.

2.3 The thinned solution should be allowed to age 12 hours at room temperature (20 C, 70 F) before use. This time is needed for the solution to reach equilibrium conditions.

2.4 After 12 hours' aging, the mixed solution can be spin coated on wafer following Photodefineable Polyimide Processing SOP. The table below shows some data for different combinations of thinner weight percentage, spin speed, exposure dose (at 20 mW/cm²) and develop time. The polyimide thickness is measured before curing and after curing at 375°C for one hour. This table can serve as a guideline for the experiment. You will have to experiment yourself to find the optimized parameters for your desired thickness and pattern feature.

Thinner Weight over Polyimide Weight	Spin Speed (rpm)	Expose Dose (mJ/cm ²)	Develop Time (sec)	Thickness (um)	
				Before Curing	After Curing
50%	3000	100	35	1.1	0.8
40%	3000	110	45	1.2	0.7
30%	3000	130	45	2.9	1.7
20%	3000	140	50	4.1	2.2
10%	3000	160	55	4.4	2.7
5%	5000	160	55	4.4	2.8
50%	5000	100	30	0.4	0.3
40%	5000	110	35	0.55	0.35
30%	5000	120	40	1.6	0.9
20%	5000	130	45	2.2	1.3
10%	5000	140	50	2.5	1.6
5%	5000	140	50	2.5	1.8

3.0 Cleanup:

Clean up following Photodefineable Polyimide Processing SOP.

4.0 Storage:

The small amber bottle of thinned polyimide should be stored in the photoresist cabinet. The larger stock bottle of polyimide should be stored in the freezer.

The T-9039 thinner should be stored in the solvents cabinet.

5.0 Waste Disposal:

Waste should be disposed following Photodefineable Polyimide Processing SOP. Both T-9039 and Polyimide liquid waste can be added to the mixed solvent waste bottle.

Dispose of T-9039 or Polyimide contaminated solid waste in the

solvent/photoresist trash.

6.0 Accident Procedures:

6.1 Contact: Read MSDS prior to working with any chemical to familiarize yourself with the symptoms of exposure and recommendations for treatment.

6.1.1 There are solvent fumes from the thinner and the polyimide. If you breathe these fumes, you may feel dizzy. If this occurs, leave everything in the hood. Leave the room and get some fresh air. If symptoms persist, contact Tufts health services and inform the lab directory and Tufts health and safety office.

6.1.2 Skin contact from the chemicals, will cause skin irritation. For minor skin contact, immediately wash skin with soap and water. Wash contaminated clothing before reuse.

For major contact, get in the safety shower and remove the affected clothing. Have someone call emergency health services.

6.1.3 Eye contact from either thinner or polyimide: Rinse well with water in Eye wash for 15 minutes. **Contact Tufts Emergency Services x6-6911.**

6.1.4 Ingestion: Do not induce vomiting. Immediately have 2 glasses water and contact **Tufts Emergency Services x6-6911.**

6.2 Spill:

6.2.1 If a small, contained spill occurs, such as inside the hood, wipe it up with chemical wipes and dispose of in the solvent trash container.

6.2.2 If a large spill occurs that you are not comfortable cleaning up, such as Breaking a bottle on the floor, evacuate the lab and contact Tufts emergency services (x66911).

6.3 Fire:

The thinner has flash pint at 130 F. Do not put it on or near the hotplates when they are turned on. If a fire starts, remove any solvents from near the fire if it is safe to do so, and exit the lab. Do not try to fight the fire.

Immediately contact Tufts emergency services once you are outside the lab at **Tufts Emergency Services at x66911.**

If at any time you feel a situation is dangerous, do not hesitate to call the safety office (x73246, Peter Nowak) or the faculty supervisor (x72210, Robert White). Please inform of the faculty supervisor and/or the health and safety office of any accident or health concern.

Report all accidents (injuries, major spills, fires) to the safety office at x73246 (Peter Nowak) and the faculty supervisor at x72210 (Robert White). For emergencies, call Tufts Emergency Services at x66911.