

Protocol: NanoStrip Cleaning

Description: The purpose of this SOP is to describe how to safely clean samples using NanoStrip. NanoStrip is a stabilized version of Piranha solution, which itself is a mixture of sulfuric acid and hydrogen peroxide.

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1 NANOSTRIP CLEANING

Safety: use minimum Personal Protective Equipment (PPE): safety glasses, nitrile gloves and non-flammable lab coat; optional PPE: safety apron and face

Note: perform all work (except for drying) in the corrosives hood and keep fume hood sash down

Materials: Nanostrip

Equipment: Corrosives fume hood

Plastic trays

Hot plate

Glass tank designated for Nanostrip (e.g. glass crystallizing dish or beaker)

IR temperature sensor

Teflon holder

Teflon-coated tweezers suitable for use with HF (hydrofluoric acid)

1. Prepare two plastic trays with deionized water
2. Place designated glass Nanostrip tank on a hot plate
3. Place cleanroom wipes under both plastic trays, between hotplate and tank, and in any space between the hotplate and the first plastic tray
4. Carefully pour enough Nanostrip to cover the sample into the tank
5. Set hot plate to 60 °C and wait until temperature of Nanostrip stabilizes
Note: Hot plate temperature should be verified; an IR temperature sensor is best for this measurement
6. Set sample onto Teflon holder
7. When the temperature of Nanostrip is stable at 60 °C, slowly submerge into the solution for at least 5 minutes with mild agitation
8. Carefully raise the sample by lifting the Teflon holder
 - i. Allow most excess liquid to drip off by gently tilting the holder
9. Transfer sample on holder to the first water bath and agitate gently for 1 minute
10. Transfer sample on holder to the second water bath and agitate gently for 2 minutes
11. Rinse thoroughly with deionized water in the sink
 - i. If the sample is a photomask, use large tweezers designated for photomasks
12. Blow dry sample with nitrogen and inspect for any debris or residue
 - i. If any debris remains, repeat steps 6-12

Note: one Nanostrip bath can be used for multiple back-to-back samples

2 CLEAN UP

Safety: use minimum Personal Protective Equipment (PPE): safety glasses, nitrile gloves and non-flammable lab coat; optional PPE: safety apron and face shield

Note: perform all work (except for drying) in the corrosives hood and keep fume hood down

Materials: Sodium bicarbonate (for disposal, if no Nanostrip waste bottle available)

Equipment: Corrosive fume hood

Plastic trays

Hot plate

Glass tank designated for Nanostrip (e.g. glass crystallizing dish or beaker)

IR temperature sensor

Teflon holder

Teflon-coated HF tweezers

1. Turn off heat and let the solution cool down to room temperature

Note: Hot plate temperature should be verified; an IR temperature sensor is best for this measurement

2. Dispose of Nanostrip into the designated waste bottle (when solution temperature is below 25° C. Suitable containers are made of high density polyethylene, Teflon PTFE, and glass. Can use PVDF at ambient temperatures.) or by neutralizing the solution with sodium bicarbonate (baking soda)
 - a. *Note: neutralizing Nanostrip with baking soda will create heat due to the exothermic reaction. If using baking soda, wait for the solution to cool down to room temperature*
 - b. *If using waste bottle, do not overfill. If you start a new Nanostrip waste bottle, make sure it has been tripled rinse and dried*
3. Rinse thoroughly the plastic trays with deionized water
4. Transfer Nanostrip tank into the sink
5. Gently fill Nanostrip tank with deionized water from the faucet and let water overflow from the tank. Leave water ON for at least 5 minutes
6. Rinse thoroughly the sides and backside of the tank
7. Dry and place back on drying rack

APPENDICES

A. RISK ASSESSMENT SUMMARY

1. Hot plate: Nanostrip releases toxic gases (sulfur dioxide and sulfur trioxide) if heated to boiling or partial evaporation
2. Nanostrip reacts violently with caustics (acids or corrosive agents) and water
3. Nanostrip reacts with organics, metal salts, ammonia, nitric acid, and reducing agents. Ignition is possible when contact is made with some of these materials
4. Acute toxicity is unknown, so it may or may not cause damage from light, long term exposure
5. Nanostrip is highly corrosive to eyes and skin. Nanostrip burns mouth and stomach and may be fatal if ingested. Inhalation causes severe mucous membrane burns, laryngeal, tracheal, bronchial, and pulmonary edema; and possibly shock and collapse

6. Overexposure causes coughing, choking, and dizziness

B. MATERIAL SOURCES

Note: Standard materials (e.g. acetone, DI water, cleanroom wipes, etc.) are not listed

Material	Supplier
Nanostrip 2X	CMC Materials, Santa Ana, CA

C. EQUIPMENT MODELS

Note: Standard equipment (e.g. tweezers, microscopes, N₂ gun, scale, etc.) are not listed

Equipment	Model #	Supplier
Hot plate	PMC 730 Dataplate	Barnstead/Thermolyne, Dubuque, IA
	1000-1	Electronic Micro Systems, Sutton Coldfield, UK