



**NPL Polarized Source Group
Technical Note # 90-1**

**Notes on Diamond Paste Polishing
of Stainless Steel**

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- The following materials are used; they may be purchased from Buehler Inc., 41 Waukegan Rd., Lake Bluff, IL 60044, (312) 295-6500.

- #40-6244 1 μ diamond paste	\$ 23.00	5 qt
- #40-6247 3 μ diamond paste	\$ 57.00	"
- #40-6250 6 μ diamond paste	\$ 53.00	"
- #40-6253 9 μ diamond paste	\$ 71.00	"
- #40-6256 15 μ diamond paste	\$ 64.00	"
- #40-6258 30 μ diamond paste	\$ 55.00	"
- #40-7062 nylon cloth	\$ 50.00	pk 10 pk
- #40-7222 micro cloth	\$ 50.00	pk 10 pk
- #40-7412 selected silk	\$ 78.00	pk 10 pk
- #40-8142-032 polishing oil	\$ 13.00	qt.

- Use a rotating table if possible, strange shapes must be done by hand. Never bear down on the work, let the diamond do the work.
- Wear Poly-D plastic gloves to avoid getting body oils on the sample, which can etch its surface.
- To charge a cloth, put 1/4-1/2" of paste from the tube on the cloth, along with a few drops of polishing oil.
- Typically, start with 15 micron paste and a silk cloth; use 30 micron paste only if the surface is rough, and has deep tool marks.
- Between each polishing step, use the following cleaning procedure in a fume hood to remove the paste and oil:
 1. if there is a lot of black residue remaining on the sample after polishing, it may be necessary to remove it by gently rubbing it off in an alcohol bath with the same type of polishing cloth just used;
 2. rinse in hot(150 F) trichloroethane;
 3. rinse off in acetone;
 4. ultrasonic clean for 5 minutes in de-ionized water;
 5. rinse off in acetone;

6. ultrasonic clean for 5 minutes in trichloroethane; then
 7. ultrasonic clean for 5 minutes in isopropyl alcohol.
- Next, use 9 micron polish with a nylon cloth. Use silk if the finish is bad.
 - 6 micron polish, with nylon cloth.
 - 3 micron polish, use nylon cloth unless the finish is good enough, then use microcloth.
 - 1 micron polish, with microcloth.
 - Use 1/4 micron polish if you wish.
 - Check the finish under a microscope to insure that the surface is smooth and free of scratches, and the finish is uniform.
 - To clean for vacuum, go through the cleaning procedure described above several times, then oven dry it at 80 C.

Notes:

1. This note is based on information provided by Jean Francis at SLAC (415)-926-3300 ext. 2533
2. The procedure for cleaning between each polishing step should be carried out using a well-ventilated chemistry hood.
3. The length of time required for each polishing stage depends, of course, on the size and shape of the piece and on the quality of the surface finish as received from the machine shop. For typical small items, such as the mirror and the cathode for the polarized source, about ten hours of polishing were required for the first stage, and about five to six hours for successive stages.
4. For polishing flat surfaces, such as the mirror used in the polarized source, it is convenient to lay the polishing cloth over a flat, perfectly smooth, metal polishing plate. The cloth can be attached to the sides of the plate with double-sided tape. The polish and polishing oil are then applied to the cloth as above, and the part (held with gloves) is moved against the plate alternating a "figure-8" pattern with back-and-forth motion in each direction.
5. If any part of the piece being polished is accidentally touched by anything other than the diamond paste and polishing oil, quickly wipe it with a lint-free tissue soaked in methanol. This will minimize the probability of damage to the surface.