



VAPOR POLISHING

Vapor polishing is a technique by which surface scratches can be removed from a plastic part, leaving a smooth, glossy finish. The scratches may result from normal use of the part or from standard machining operations performed in the fabrication of plastic parts, either for production or prototyping. Machining operations include turning, drilling, milling/routing, and sawing (edge polishing).

Methylene chloride (dichloromethane, CH_2Cl_2) is the specific solvent used for vapor polishing LEXAN® resin parts. Two techniques are described: surface polishing and edge polishing. Both operations are very similar; the latter is a modification of surface polishing developed by the Sheet Products Department of the General Electric Plastics Operations. It involves a slightly different equipment set-up which is better suited to polishing a relatively thin edge as compared to a large surface.

Surface Polishing

- 1) Light surface scratches and haze need not be removed by sanding. However, the surface should be at least as smooth as that obtainable with 600 grit abrasive, preferably hand-sanded. For deeper scratches and imperfections, start with a coarser grit and work up to a 600 grit or finer finish.
- 2) Clean the part to remove any oils, greases, or other foreign materials (dirt, fingerprints, grit generated by sanding, etc.). Use only compatible cleaning solutions. Isopropyl alcohol is recommended, though methyl or isobutyl alcohol can also be used. Cleaning with a mild soap solution (1% liquid Joy* in water, as an example) is often acceptable, though it may be difficult to fully remove organic materials (greases, oils) and fingerprints. Thorough rinsing is essential when cleaning with a soap solution.
- 3) Dry the part thoroughly. In some cases it may be necessary to remove static charge and accompanying dust with an ionizing air gun.

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- 4) Boil a container of methylene chloride on a small electric heater or hot plate in a hood or other well ventilated area**. The solvent, which boils at 40.1°C (104°F), will form a visible vapor layer above the liquid's surface, the depth of the layer being dependant on the rate of boiling (heater input). Thus, the container's size should be based on the overall dimensions of the part being polished such that the entire surface can be suspended in the vapor without touching the liquid.
- 5) Suspend the LEXAN resin molded part in the methylene chloride vapor for two to three seconds. Because exposure time is critical and must be controlled closely, the technique generally requires some practice. Again, ensure that the part does not touch the boiling liquid.
- 6) Remove the part and dry at room temperature for 1 to 1½ hours. This ensures that the majority of residual methylene chloride evaporates from the part so that subsequent annealing does not result in bubbling caused by entrapped solvent flashing off.

During polishing and before initial drying, careful handling is necessary to avoid the transfer of fingerprints to the vapor-softened surface.

- 7) Anneal the part at 250°F to remove surface stresses. An annealing time of 15-20 minutes is generally sufficient, though further experimentation on the length of time, followed by end-use testing, is often advisable where harsh operating environments are expected (impact, high loading, chemical exposure, etc.). The minimum annealing time that produces a part which satisfies the end-use requirements is recommended.

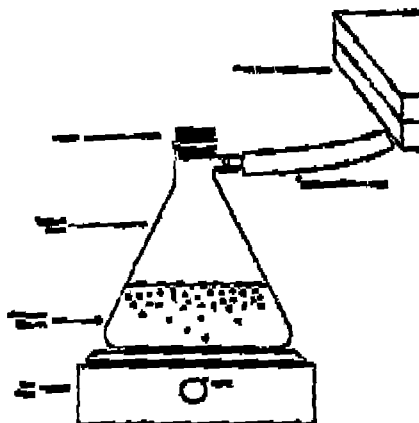
NOTE: In addition to annealing for physical performance, all residual methylene chloride should be removed if the part is to be painted or re-coated.

**NIOSH and OSHA recommendations should be considered when using methylene chloride.

Edge Polishing

- 1) Remove any cutting tool marks produced by a saw or router by manually scraping the edge of the part or sheet with a 90° standard paint scraper. The tool should be sharp and free of any burrs or indentations.
- 2) Sand the edges, typically starting with 220 grit "wet or dry" abrasive, keeping the pad wet to avoid buildup. An orbital or reciprocating sander can be used. Proceed to a finer grit abrasive (320 grit "wet or dry", as an example) and finish sanding with 600 grit abrasive, preferably by hand. Clean the part as outlined in step 2 of Surface Polishing.
- 3) Set up a small electric heater and a vacuum flask (or other modified vessel as shown below). A 3 foot length of hose is convenient. If the hose is too short, maneuverability is restricted; if too long, the vapors will condense before exiting.

Small Solvent Evaporator



- 4) Boil a suitable amount of methylene chloride, keeping the hose approximate 2 inches from the part's edge. Slowly and steadily direct the vapor along the edge. The surface will very quickly become glossy, though it is always better to return to an area for touch up than to apply too much vapor at a time. After air-drying for about 1 minute, the vapor can be reapplied if necessary to achieve a uniform surface.

Mask the part or sheet where possible to restrict solvent contact to the edges. Any liquid that inadvertently contacts the surface should be removed quickly.

- 5) As with surface polishing, the part or sheet should be adequately dried before handling. Annealing may also be necessary for optimal physical performance depending on the end-use environment.

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NOTE: Techifacts may be filed under the Technical Reports tab in your LEXAN binder.

Vapor Polishing

Minor surface scratches can be removed from LEXAN resin parts by vapor polishing as follows:

1. Clean the part with a compatible solvent, finishing with a mild soap-and-water washing (1 percent liquid Joy[®] in water).
2. Dry the part thoroughly.
3. Remove all dust from the surface—preferably with an ionizing air gun.
4. Boil a container of methylene chloride in a hood or well-ventilated area.**
5. Suspend the LEXAN resin part in the methylene chloride fumes for less than three seconds. (Do not allow the part to contact the boiling liquid.) Exposure time is critical and must be controlled closely.
6. Remove the part to dry—allowing time for the methylene chloride to evaporate before handling. Keep in a clean area relatively free from dust. After initial evaporation, drying should be gradual (5 to 10°F per hour), accelerated by the use of an air circulating oven. A final drying cycle of one hour at 250°F (121°C) is required to remove surface stresses as well as entrapped methylene chloride.
7. Careful handling during the polishing operation is necessary to avoid transfer of fingerprints to the vapor-softened surface.

CAUTION: All methylene chloride should be removed if the part is to be painted or recoated.

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**NIOSH, OSHA and EPA recommendations should be considered when using methylene chloride.

Metallizing

Vacuum Metallizing

Vacuum metallizing coats a plastic part with a thin layer of metal, usually aluminum. The part may be first sprayed with a clear base coat to

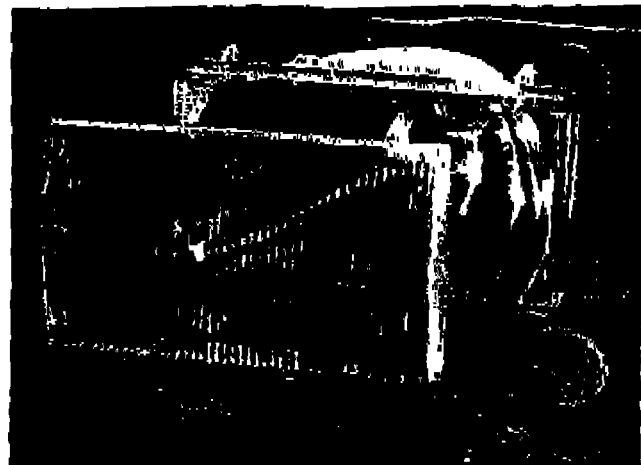
promote adhesion. The metal is then boiled in a vacuum chamber, and the condensing metal is deposited on the surface of the part. After the part is removed from the chamber, it is usually sprayed with a top coat to protect the metallized layer, and sometimes to change the tint of the metal surface.

Since LEXAN resin is naturally transparent, vacuum metallizing can be either first or second surface. Second surface is preferred because a tough layer of LEXAN resin protects the vacuum metallized layer. In some second-surface applications no base coat is needed, and the metal layer can be vacuum deposited directly onto the LEXAN resin part. However, glass-reinforced grades of LEXAN resin require a base coat to insure surface smoothness.

The mold for a vacuum metallized part should have a highly polished surface. Gating should also be considered to avoid gate blush, because the vacuum-deposited layer will accentuate minute defects in the part.

It is also important that the parts be kept clean and bagged after molding. If the surface should become contaminated, clean it with isopropyl alcohol. If the surface is scratched in machining operations, vapor polish before vacuum metallizing.

The base and top coats for vacuum metallizing are generally clear paints with solvent systems compatible with LEXAN resin.



Vacuum metallizing provides the reflective "mirror like" surface on this automotive headlamp housing of LEXAN resin.

Cleaning And Maintenance Guidelines

Cleaning Instructions

When LEXAN sheet is first installed, glazing compound and masking paper adhesive can be easily removed by applying naphtha (VM&P) or kerosene with a soft cloth, followed immediately with a thorough soap and water cleaning. **DO NOT USE GASOLINE.** Adherence to regular and proper cleaning procedures is recommended to preserve appearance.

Washing to Minimize Scratching

Wash LEXAN XL sheet and LEXAN THERMOCLEAR sheet with a mild soap or detergent (e.g., Joy¹ Dishwashing Liquid) and luke-warm water, using a clean sponge or soft cloth. Rinse well with clean water. Dry thoroughly with a chamber or moist cellulose sponge to prevent water spots. Do not scrub or use brushes on these products; their coating is UV-resistant, not mar-resistant. Also, do not use butyl cellosolve in direct sunlight.

Fresh paint splashes, grease and smeared glazing compounds can be removed easily before drying by rubbing lightly with a good grade of VM&P naphtha or isopropyl alcohol. Afterward, a warm final wash should be made, using a mild soap or detergent solution and ending with a thorough rinsing with clean water.

Minimizing Hairline Scratches

Scratches and minor abrasions can be minimized by using a mild automobile polish. Three such products that tend to polish and fill scratches are Johnson Paste Wax, Novus Plastic Polish #1 and #2, Novus Inc., Minneapolis, MN, and Mirror Glaze plastic polish (M.G. M10), Mirror Bright Polish Co., Pasadena, CA. It is suggested that a test be made on a sample of LEXAN sheet with the product selected and that the polish manufacturer's instructions be followed.

Some Important "Don'ts"

- DO NOT use abrasive or highly alkaline cleaners on LEXAN sheet products.
- Never scrape LEXAN sheet products with squeegees, razor blades or other sharp instruments.
- Benzene, gasoline, acetone or carbon tetrachloride should never be used on LEXAN sheet products.
- DO NOT clean LEXAN sheet products in hot sun or at elevated temperatures.

Compatible Cleaners for LEXAN Sheet Products

The following cleaning agents have been found compatible with LEXAN sheet, LEXAN XL sheet and LEXAN THERMOCLEAR sheet. The manufacturer's recommendations and instructions should be followed.

- Joy¹
- Freon T.E.
- Palmolive Liquid²
- Top Job³
- VM&P grade naphtha
- Windex with Ammonia D²

LEXAN MR5 Sheet Cleaning Instructions

Because of this material's highly mar and UV-resistant coating, avoid the use of abrasive cleaners and/or cleaning implements that may mar or gouge the coating.

Graffiti Removal

- Butyl cellosolve, (for removal of paints, marking pen inks, lipstick, etc.)
- The use of masking tape, adhesive tape or lint removal tools works well for lifting off old weathered paints.
- To remove labels, stickers, etc., the use of kerosene, VM&P naphtha or petroleum spirits is generally effective. When the solvent will not penetrate sticker material, apply heat (hair dryer) to soften the adhesive and promote removal. **GASOLINE SHOULD NOT BE USED.**

Job Site Precautions

New construction and renovations frequently require that the glazing and surrounding sash and wall finish be cleaned of any excess mortar, paint, sealant, primers or other construction compounds. Only recommended cleaners should be used to clean LEXAN sheet. Contact with harsh solvents such as methyl ethyl ketone (MEK) or muriatic acid can result in surface degradation and possible crazing of LEXAN sheet.

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²Registered Trademark of Colgate Palmolive.
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