Description

Image



Image caption

(1) A machine used to etch glass at Thinktank Birmingham Science Museum © Ell brown at Wikimedia Commons (CC BY 2.0) (2) The glass etching process. Turning glasses in a chemical acid etching process © at Wikimedia Commons [Public domain] (3) Glass Etched © JamesDeMers at Pixabay [Public domain]

The process

There are three basic processes for etching. CHEMICAL ETCHING, a method that is widely used to decorate to glass, metal and polymer objects. The areas or patterns to be etched are exposed to an acid; the areas that are not to be etched are protected with a wax resist. Glass used to be etched by hydrofluoric acid, a particularly nasty chemical that gives off poisonous fumes; today this has largely been replaced by proprietary etch-gels, by sand etching or by engraving with a diamond tool. Copper, zinc, nickel and steel are etched in various combinations of sulfuric, nitric and hydrochloric acids. These, too, create environmental problems. SAND ETCHING makes use of a jet of angular sand particles in a pressurized gas stream to erode the surface where it is not protected by a mask. The rate of etching and the fineness of the finish depend on the air pressure and sand particles size. The method also works well with polymers. ELECTRO-ETCHING is a non-toxic way of etching of metals. Here the acid bath is replaced by one of copper sulfate (for etching copper) or zinc sulfate (for etching zinc) that never has to be changed. The object, protected by wax resists where necessary, is made the anode (+) of an electro-polishing bath, cutting into the areas of surface not protected by the resist.

Process schematic

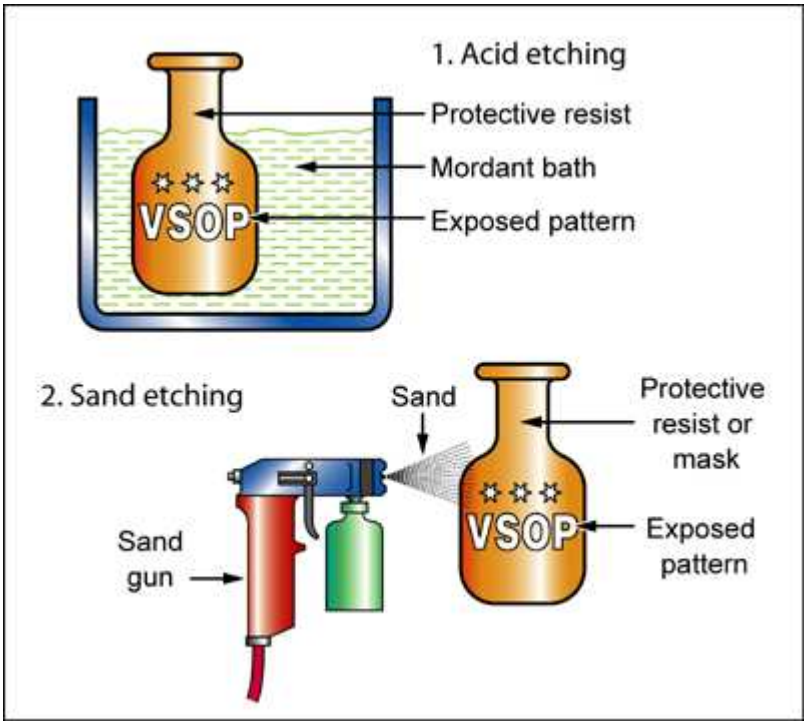

Figure caption

Chemical and abrasive etching

Material compatibility

Ceramics	✓
Composites	✓
Glasses	✓
Metals - ferrous	✓
Metals - non-ferrous	✓
Natural materials	✓
Polymers - thermoplastics	✓
Polymers - thermosets	✓

Function of treatment

Friction control	✓
Decoration	✓
Reflectivity	✓
Surface texture	✓

Economic compatibility

Relative tooling cost	low
Relative equipment cost	low
Labor intensity	high

Physical and quality attributes

Surface roughness (A=v. smooth	B
Curved surface coverag	Average
Processing temperature	80.3 - 170 °F

Process characteristics

Discrete	✓

Supporting information

Design guidelines

Etching is widely used to pattern glass and metal. The freedom of design is limited only by the technique for creating the wax pattern of resistance.

Technical notes

The surface must be cleaned before applying the ground. Techniques exist to etch glass, tile, wood, stone, metals, polymers. The acids used to chemical etching, are by their nature, particularly aggressive, requiring special containers, handling and disposal. Sand etching is less demanding, but less controllable.

Typical uses

Etching is widely used for the decoration of glass, metal, polymer or wood objects. In art: jewelry, ornaments, clocks, bookmarks, photographs etched into metal, medallions, street art, event posters, light switches. In advertising: plaques, business cards, graphic plates for brochures, awards, cover elements for annual reports, logos or tags to be placed on products, elevator button plates, signs to go on doors, name plates, insignias, face plates office decorations.

The economics

Chemical etching is slow and expensive. Sand etching and electro-etching are faster and cheaper.

The environment

Chemical etching presents major environmental problems associated with toxic fumes, aggressive chemicals, and the difficulty of disposing of spent baths. Sand etching and electro-etching have none of these problems.

Links

MaterialUniverse

Reference