Technical Information Sheet

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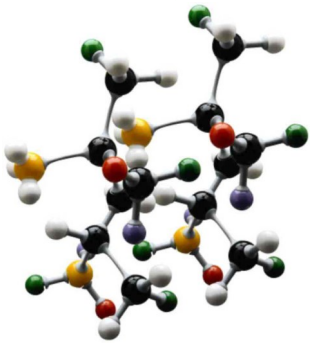
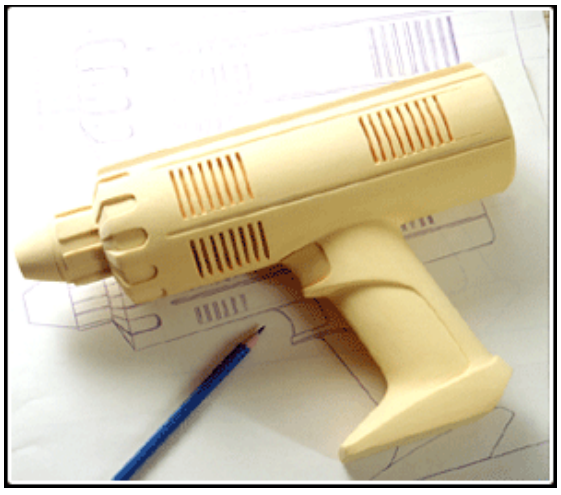


Prototyping Foams Rigid PUR Foams, Machineable Rigid Foams, Modeling Foams, Pattern Foams, Styling foams, Tooling Boards.

General Description

- Historically, designers and tool-makers would craft their products from wood. Due to increasing scarcity of high-quality wood stock, rising costs, and the difficulties and health dangers associated with the use of wood, this practice is changing.
- While wood has been commonly available and plentiful for centuries, the requirements of 21st-century industry are sidelining its use in tooling and design-modeling.
- Polyurethane foams are becoming increasingly important as replacement products for wood in several applications where substrate consistency and resistance to moisture and decay are important.



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A natural product, wood often contains inconsistencies and defects (grain effects, knots, wane, checking, splits) affecting performance in cutting and (especially) CNC-machining operations, resulting in longer machine-times and higher costs.

Even special, select-grade wooden "pattern boards" contain tannins and mold-spores, potential health-hazards released in cutting operations. Wood is also susceptible to dimensional changes due to its affinity for water, and its isotropic grain-structure.

With designers and tool-makers needing fast processing, tighter tolerances and reliable dimensional stability in prototyping and manufacturing operations, the correct synthetic material often out-performs what Mother Nature provides.

In 1959, Mr. M. Sarangapani, founder of U-Foam Private Limited, the "Father of Polyurethane Foams in India" brought this wonder material to India.

Polyurethane foams are becoming increasingly important as replacement products for wood in several applications where substrate consistency and resistance to moisture and decay are important. The excellent chemical and solvent resistance of urethane compounds makes them useful where many other resins might fail.

These synthetic materials are playing an ever-larger part in manufacturing and new-product design.

U-Foam brings you today rigid synthetic boards for prototyping, styling, and tooling applications. While they are more costly than wood, on a per-unit cost basis, the advantages of using tooling board materials lower their total cost in a project to very reasonable levels.

Tooling-boards are generally classified by density, encompassing a wide range of options, from medium-density foams to very dense, solid-plastic planks. This allows users to match materials to job requirements, while controlling costs.

Some tooling boards are "syntactic" foams, where very small glass or plastic "bubbles" are mixed with resin to create a specific-density block.

Other boards are "expanded" foams, where carbon-dioxide gas, a by-product of chemical reactions, makes cells to create a specific density. Both manufacturing methods render consistent boards with no voids, uniform density, and predictable processing characteristics.

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Advantages of Prototyping Foams

•**Ease of Machining** — Because prototyping foams boards are consistent, uniform, and grain-free, concerns with cutting-direction, tear-out, and warping are few. Faster CNC-machine spindle speeds and material feed-rates are possible, increasing productivity. Manufacturers offer advice on cutters, spindle-speeds, and material feed-rates for their materials.

•**Shop Safety** — Most prototyping foam board products create shavings when cut, and many contain anti-static additives, for reduced shop dust on the floor and in the air.

•**Dimensional Stability** — Prototyping foam boards are closed-cell, and predominantly polyurethane-based, making them relatively insensitive to humidity changes. Thermoset polyurethane polymer has predictable thermal expansion characteristics. Good processors treat their boards to remove residual stresses, eliminating warping.

•**Temperature Resistance** — Most boards are useful up to 65 degrees C, with many usable at temperatures of 100-115 degrees C. Some boards can be processed repeatedly at 120 degrees C.

•**Larger Block Sizes available** — Some manufacturers offer shapes up to 300mm thick, and up to 1500mm x 500mm in length and width, greatly reducing glue-up labor in build-ups. This is a tremendous advantage over wood products.

•**Easily Bonded and Repaired** — Many manufacturers offer specific adhesives and patch compounds for toolingboards, matched to particular grades.

•**Easy Surface Finishing** — Almost all of these products accept a wide-range of coatings and finishes. Small cell-sizes give very good (to excellent) finished surface results. It is possible, with electroless-plating processes, to create polished-metal surfaces on prototypes made with tooling boards and foams.

Each density-range of prototyping foam tooling board has typical applications. None of these suggestions are hard-and-fast rules. Instead, use them as starting points for consideration in using tooling boards in manufacturing operations.

Keep in mind: Higher Density=Higher Cost.

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Examples of prototypes made with prototyping

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Application Information

•High-density boards (>480 kg per cubic meter) are used where manufacturing stresses are high, or where exact dimensional tolerances, sharp-corner retention, and excellent surface-finish is important. Vacuum-bag tools, thermoforming molds, hydro-forming tools, check-fixtures, foundry patterns, trim-fixtures, and highly-detailed models or prototypes benefit from use of this grade of tooling board.

•Medium-density boards (<480 kg per cubic meter) are useful for styling applications, mold-patterns, and CNC-program proofing. Fine-detail rendering and surface-finish quality is not as good as in more-dense boards, but adequate for many purposes at a reduced cost.

Some automakers create entire concept-cars with tooling-boards in this density range. Forming tools for acrylic plastics, low-rate and prototype thermoforming tools, and molds for low-temperature-curing are also made with these materials.

•Low-density boards (<240 kg per cubic meter) Really high-density foams, these are used for quick design studies when hand-carving is easier and less expensive than CNC programming and machining.

Used for "sight" models, theme-park characters, architectural studies, or topographical maps, these boards are very low-cost.

Automotive design-houses (with large-envelope CNC routers) will sometimes craft prototype car-body styles directly from CAD programs using foam.

We are pioneers in the formulation of high-performance Polyurethanes, Flexible, Semi rigid, Rigid cellular solid polyurethane and polyisocyanurate products.

Over the last five decades, U-Foam has earned an outstanding reputation for developing unique foam-based technical solutions to difficult problems.

In the 21st century, U-Foam seeks to continue its enviable record of accomplishment through pursuit of chemical innovation and manufacturing excellence in its key core competency

Typical Densities

125 kg/m3

150 kg/m3

200 kg/m3

250 kg/m3

300 kg/m3

400 kg/m3

450 kg/m3

500 kg/m3

600 kg/m3

700 kg/m3

800 kg/m3

Typical tolerance in density is +/- 5%

Various Taylor made densities are available on request

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IMPORTANT NOTICE REGARDING FLAMMABILITY—All polyurethane foams including combustion modified foams will burn and generate smoke and gases. Performance conditions and corresponding data refer to typical performance in specific tests, such as UL-94 and MVSS-302, and should not be construed to imply the behavior of this or any other product under other fire conditions. All data regarding these products were obtained using specific test methods under controlled laboratory conditions intended to measure performance against specifications. Due to the great number and variety of applications for which U-Foam products are purchased, U-Foam does not recommend specific applications or assume any responsibility for use results obtained or suitability for specific applications. IN NO EVENT SHALL BE RESPONSIBLE FOR ANY CLAIM IN EXCESS OF U-FOAM'S SALE PRICE OF THE PRODUCT TO WHICH THE CLAIM RELATES.

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