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News to Use
Design Requirements Manual
The formulae $\frac{\partial \rho U_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho U_j U_i)=-\frac{\partial P}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial U_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho\overline{U_i}\overline{U_j})=-\frac{\partial \bar{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu\frac{\partial \overline{U_i}}{\partial x_j}-\rho\overline{u_i'u_j'}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho\overline{U_i}\overline{H})=\frac{\partial}{\partial x_i}\left(\lambda\frac{\partial \overline{T}}{\partial x_i}-\rho\overline{u_i'h'}\right)$ biomedical research facilities.
'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'.
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Epoxy Resin Benchtops

The last two issues of News to Use provided overviews of lab grade plastic laminate and phenolic resin as options for laboratory benchtops. This month the topic is the most commonly used benchtop surfaces, epoxy resin.

Epoxy resin is the successor of traditional soapstone benchtops, and has been the workhorse material in chemical-intensive laboratories for many years. Epoxy resin is an oven-cured mixture of epoxy resin, silica, a hardener and filler materials.

Characteristics:
The standard epoxy resin sheet used for benchtops is 1" thick, but ¾" and 1 ¼" are also available. The largest available sheets are 72" x 96", so joints are necessary in long runs of benchtop. Joints are butt-type, with metal splines and epoxy adhesive. Leading edges can either be beveled 1/8" or radiused 3/16". An applied or integral marine edge is available, as are drip grooves and other profiles.

Because epoxy resin is a monolithic material under mount sinks can be used. Sinks can be epoxy resin, sealed to the benchtop with epoxy adhesive to create an integral assembly, stainless steel or other materials. Backsplashes, reagent shelves and bottle racks can be fabricated from epoxy resin material.

Because it is monolithic and does not absorb liquids, epoxy resin can be easily cleaned. Light surface abrasions can be repaired with commercially available cleaning products. For deeper cuts or stains an orbital sander with 120 grit or finer wet/dry sand paper can be used.

Black is the standard color, but epoxy resin countertops are also available in several other colors, including grey, blue, tan and white. Color choices other than black will incur cost increases anywhere from 15% to 45%.

Advantages:
Epoxy resin has a number of properties which makes it a good choice for benchtops in most laboratory applications:

- **Chemical resistance:** Epoxy resin is non-absorbent, stain resistant and is highly resistant to most commonly used laboratory acids, solvents and other chemicals. It is also monolithic, so scratches do not reduce its chemical resistance.
- **Durability:** Epoxy resin is hard and dense, so it is durable and abrasion resistant. Because it is monolithic, it does not delaminate.
- **Heat and flame resistance:** Epoxy resin is non-flammable and resistant to high temperatures.
- **Versatility:** Epoxy resin is available in molded shapes including marine edges, integral backsplashes, sinks, pegboards and other laboratory accessories (figure 1).

Other Considerations:
In recent years alternate materials, including phenolic resin and chemical resistant plastic laminate, have become available as alternatives to epoxy resin. These materials approach the chemical resistance of epoxy resin, and have some distinct advantages over epoxy resin which should be considered during the selection process:

- **Weight:** At about 12 lb./sq. ft. epoxy resin is substantially heavier than alternate materials. Weight can be an advantage for increasing the stability and vibration characterizes of benches and furniture, but can be a disadvantage, especially for mobile and adjustable benches. Weight also increases fabrication, shipping and installation costs.
- **Fabrication:** Because of epoxy resin's density and harness, it must be cut with diamond-tipped blades and the use of water-cooling of blades is recommended. Most epoxy resin fabrication must be done in a fabrication shop, unlike other materials which can be modified and fitted on site. This results in higher fabrication costs and makes future modifications more difficult.
- **Cost:** The material cost of epoxy is more than alternates. Epoxy resin is also more costly to fabricate ship and install.
- **Resistance to low temperature:** Although it resistant to high temperatures, epoxy resin is susceptible to damage from thermal shock from low temperatures, and may crack if exposed to liquid nitrogen or other cryogens. This is an especially problematic with epoxy resin sinks, when dry ice is placed in the sink to sublimate, resulting in cracking.

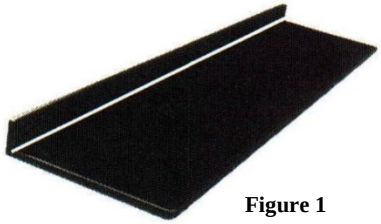

Figure 1
Epoxy resin benchtop with integral backsplash

Sustainability:
This material has limited value in obtaining credit for use of sustainable products. Recycled silica or filler can be used in the manufacturing process, but epoxy resin is generally not recycled or recyclable.

Epoxy resin is a very durable, stable, and long lasting laboratory countertop material. Even though this material has a higher first cost, its durability, chemical and heat resistance can outperform less expensive materials in life cycle cost. When old labs are renovated, it is often the epoxy resin countertop which has retained its appearance and usefulness over time better than any other finish material in the space.

Further details on this month's topic are available on the DRM website
http://orf.od.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/Pages/DesignRequirementsManualPDF.aspx
DRM Chapter 4 Section 4-5 Casework and Equipment