Miracle Insulation

Q. I recently read an advertisement in which a new "miracle" insulation rated at R-16 per inch had passed initial tests at Oak Ridge National Laboratories. Do you have any information on this material?—*Blair Sponaugle, Sunleader Corp., Roswell, N.M.*

A. For over two years, Oak Ridge National Laboratories has investigated exotic high-R insulations for use in appliances. The most promising contender to emerge has been ultra-fine (200 angstroms) "fumed" amorphous silica particles sandwiched in an evacuated panel of aluminized plastic. One prototype panel from France has consistently tested at R-16.6 per inch for over two-and-a-half years—demonstrating the panel's ability to hold its vacuum, at least in a lab setting. The panel's main drawback is the powder's exorbitant cost. Preliminary tests on a far cheaper substitute—a waste product of silicon production—have been very encouraging, with test results as high as R-34 per inch.

It's important to note that if the panel is punctured or damaged, the vacuum and the high R-values are lost. This would likely preclude most building applications, though use in appliances is promising. A research report is due out this month from Oak Ridge. It's called "Development of Advanced Thermal Insulation for Appliances" ("ORNL/TM-9121) and will be available from the Government Printing Office.

As for your advertisement, we suspect this is misuse of the Oak Ridge findings, since these products have yet to emerge from the lab.

Rigid-Insulation Ducts

Q. I have heard that rigid insulation can be used to construct heating ducts. Can you provide information about the construction of these ducts, including tools, etc.? Is it reasonable to use these with a thermosiphoning air collector (TAP), considering that I desire to move air 12 to 15 feet from the south wall to the middle of a one-story house? This plan also includes using air from the basement to enter the cold side of the TAP.—*Byrl Bowman, Kalamazoo, Mich.*

A. The product you refer to is fiberglass duct board, available from Certainteed, Knauf, and Owens-Corning. The one-inch-thick, R-4.3, rigid-fiberglass panels have a reinforced kraft/foil facing on one side. The panels can be cut and fit on-site, using a utility knife and special grooving tools to make the folds and laps. The sections are stapled together and sealed with pressure-sensitive aluminum tape. The hand tools are made by AmCraft, Inc., 2311 Mechanic St., Waterville, Ohio 43566. Since this product is currently more popular in the south, you may have some difficulty finding it locally. Check with larger heating and air-conditioning supply houses or a manufacturer's rep.

As for your plan, it sounds fine, but don't expect much airflow from a thermosyphoning collector if the system is ducted. A fan is necessary.

Covering the Slab

Q. I'm in the process of building a home. Are there any floor-covering products I can install over a precast concrete second floor and concrete slab first floor that are resilient (soft clay brick?) and yet have thermal mass properties? I understand the necessity for the mass, but I'd like to find a more pliable floor covering.—*Roger Snodgrass, Barnesville, Ohio.*

A. Assuming you are interested in using these floors for direct-gain passive solar storage, we see two possible approaches: 1) try to find a material that has a high heat capacity, or 2) look for a material with negligible heat capacity but good absorptivity and conductivity. This will allow the covering to transfer heat into the concrete floor, which has a high heat capacity.

We know of no soft floor covering with high heat capacity, but the second approach shows some promise. A recent study by industry researchers concluded that any covering whose thermal conductance exceeded about 10 Btu/hr-ft² would not impair the thermal storage capability of the concrete floor. This eliminates even the thinnest carpets (C=0.8) and some vinyl floor coverings, but includes vinyl-asbestos tile (C=43) and sheet vinyl on felt backing (C=21.2). Beyond C=10, increasing the absorptivity does more than increasing the conductivity. Light colors absorb less solar radiation and are thus less efficient (as much as 40 percent less, for pastels). Also, it's important to install the covering so that it makes very good thermal contact through a continuous bond with the floor slab.

Low-density brick and other "soft" masonry materials are not ordinarily considered resilient. If they are well bonded to the slab, they will not reduce its thermal performance much.

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