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THE WORD:

PLASTIC BUILDING MATERIALS

By Bruce Barker

Bruce Barker is the founder and president of Dream Home Consultants LLC and the author of Everybody's Building Code, *written to help home inspectors understand the International Residential Code. Bruce has been building and inspecting homes since 1987. He currently serves as ASHI President-Elect. He is a certified Residential Combination Inspector and a licensed contractor in Arizona, Florida and North Carolina. To read more of Bruce's articles or if you need a presenter at your next chapter event, go to www.dreamhome-consultants.com.*

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Once again, The Word invites you to travel into the dark realm of subjects that may be of interest to home inspectors. The Word hopes you will find this trip informative and maybe a little entertaining.

Our subject this month is plastic building materials. The Word finds this subject interesting because these materials can be a fire hazard. They can ignite easily and, if they ignite, the flame can spread quickly. Smoke developed by plastic building materials is thick and toxic, which makes it particularly dangerous to occupants and to firefighters. There are, therefore, rules about covering foam plastic building materials to reduce the chance of ignition. It's good to be able to identify these materials and to be familiar with the covering rules, because we will be seeing more foam plastic building materials, especially in closed crawlspaces and closed attics.

Plastic building materials are in almost every part of a modern house, from the vapor retarder under the foundation slab to the plastic roof-covering materials.

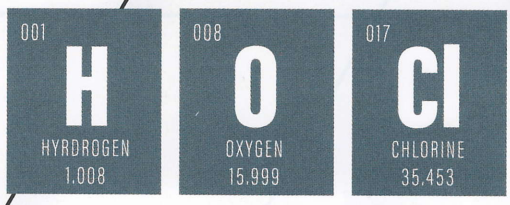
Plastic Primer

Most plastic begins with hydrocarbon molecules (from oil, natural gas or coal), so it makes sense that plastic might burn or at least melt. The refined hydrocarbon molecules (monomers) are bonded to other molecules such as hydrogen, oxygen and chlorine to form polymers. The polymers can be combined with other molecules to produce plastic materials with an almost unlimited number of characteristics.

Plastic building materials are in almost every part of a modern house, from the vapor retarder under the foundation slab to the plastic roof covering materials. Plastic is used to make many types of insulation. Plastic is also used to make air barriers, water barriers and vapor retarders. Lots of decorative trim components are made from plastic. Plastic is mixed with other materials to make composite materials such as deck floor boards. Thermoset plastic adhesives are used to make plywood and oriented strand board (OSB), and to make finger-joint studs and engineered lumber.

In theory, it's possible to build a house almost entirely out of plastic. (Wonder what the Big Bad Wolf would say about that?) Plastic structural members are available. There is even electrically conductive plastic, although this isn't practical for use as house wiring. You would still have to use copper for the wiring.

Microcellular foam plastic is one type of plastic building material. It is often used as insulation in residential construction. It is also used for components such as interior trim and various types of interior finish materials. Foam plastic is made by heating plastic under pressure and injecting a gas into the plastic to create uniformly distributed gas bubbles in the plastic. The foam plastic is then formed into sheets to make sheet insulation or it is sprayed on a surface as spray foam insulation. Foam plastic has some good characteristics such as being lightweight, dimensionally stable, insect resistant (although they can tunnel through it) and relatively inexpensive. The most significant downside is its propensity to ignite and burn.



Building Materials and Fire

The burning characteristics of building materials vary. Inorganic materials like metal and concrete don't burn at all. Organic materials like wood and plastic will burn. The burning characteristics of building materials can be measured using a standardized test, such as ASTM E84. This test measures the flame spread and smoke developed characteristics of building materials. As the names suggest, ***flame-spread*** is how quickly a material burns and ***smoke-developed*** is how much smoke is created when the material burns. This test doesn't measure how easily a material ignites.

The 2018 International Residential Code (IRC), Section 316, has maximum values for the flame-spread index and the smoke developed index. These values are 75 for the flame-spread index and 450 for the smoke-developed index. We don't care how these values are determined, what these values mean or whether they accurately measure the burning characteristics of building materials. All we need to know is that these values exist.

Thermal Barrier

Since foam plastic usually can ignite easily, the general rule is that it should not be left exposed to the interior of a building. Foam plastic should be covered by a thermal barrier. The most common thermal barriers are ½-inch thick drywall and ¾-inch thick wood structural panels. Exposed foam plastic usually isn't an issue for home inspectors because it is covered by something. In attics, basements, crawlspaces and garages, however, you may find exposed foam insulation. When you see foam plastic, your Spidey Sense should tingle and prompt you to look more closely at the situation.

Here's where things get interesting. The general rule about covering foam plastic with a thermal barrier has lots of exceptions. Compliance with some of these exceptions is relatively easy to determine visually. Sometimes, however, it's not easy at all.

When you see foam plastic, your Spidey Sense should tingle and prompt you to look more closely at the situation.

Ignition Barrier, Attics and Crawlspaces

It's okay to have foam plastic insulation exposed in an attic or a crawlspace, but only if several conditions are met. The conditions include that access to the attic or crawlspace is required by the IRC, and that the only reasons to enter the crawlspace are for repairs or maintenance. The space may not be used for storage. The conditions also include that the foam plastic insulation should be covered with an ignition barrier. Examples of ignition barriers include mineral fiber insulation, wood structural panels and corrosion-resistant metal.

Covering large areas of foam plastic insulation with an ignition barrier could be an expensive challenge and could limit the use of this material in closed attics and crawlspaces. So, how do they get around this challenge? Read on.

The Specific Approval Exception

Any type of foam plastic building material may be exposed to the interior of a building without a thermal barrier or an ignition barrier if the material has been tested and approved to be installed exposed, and if it has been installed according to the conditions of the test and of the approval. One of the conditions of the test may be covering the foam plastic with a liquid intumescent coating.

So, how does a home inspector visually determine whether the foam plastic insulation has been tested and approved, and whether the material has been installed according to the test conditions? See Photos 1 and 2. The Word isn't aware of a way we can do this unless the approval reference is printed on the material. See Photo 3. So what should we do?

Reporting this situation is the same as reporting any other possible defect. Report what you see; in this case "exposed: foam plastic insulation." Explain the implication; in this case: "The insulation may be a fire hazard, depending on how it has been installed." Recommend obtaining documentation about manufacturer's installation instructions and about how the foam plastic was installed. Without documentation, a qualified insulation contractor will need to determine what should be done.

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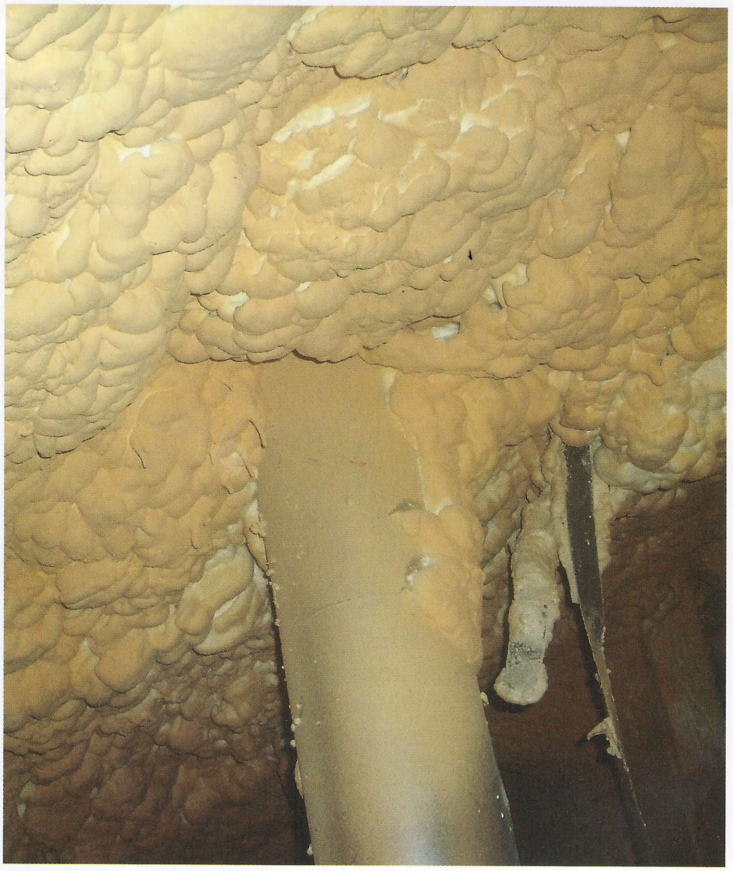

Photo 1. Can you tell if this spray foam insulation is installed according to the test conditions? The Word can't.

Photo 2. This spray foam insulation is installed according to the test conditions, but the only way The Word could tell is that it's installed under his house.

Photo 3 This Extruded Polystyrene Foam (EPS) insulation board should be covered in an attic. It says so right on the board.

Other Exceptions

Dealing with building codes is often not easy. General rules are often followed by a long list of what seem to be obscure exceptions that are often presented in footnotes printed in very small fonts. The general rule about covering foam plastic with a thermal barrier has many more exceptions in addition to those we've discussed. Many of these exception situations are concealed during a home inspection, so we don't have to deal with them.

One of these exceptions is applying spray foam plastic insulation to sill plates, bands and headers. It is okay to apply spray foam insulation to these components if the insulation is not more than 3 ¼ inches thick.

Another exception is a requirement in areas where wood-destroying organisms are a problem: to leave a gap between the insulation on a foundation wall and the framing to allow for inspection. This gap is often about three inches.

Types of Foam Insulation

We may encounter several types of foam plastic insulation. All types should be separated from the building interior by a thermal barrier or should comply with one of the exceptions.

Expanded Polystyrene (EPS) sheets are usually white, and look like a bunch of small white beads that have been glued together. EPS is quite common in some markets as sheathing under 1-coat and two-coat stucco. EPS has an R-value of between about 4 to 5 per inch, depending on the density. At one-inch thickness, EPS is a Class III vapor retarder. It is an air barrier if the seams are sealed. This is usually the least expensive of the sheet insulation materials. See Photo 4.

Photo 4 XPS insulation board is often used as sheathing under one-coat stucco. It will be covered on both sides, so there's no ignition risk.

Extruded Polystyrene (XPS) sheets are usually pink, white or green, depending on the manufacturer. XPS has an R-value of about 5 per inch. At 1-inch thickness, XPS is almost a Class II vapor retarder. It is an air barrier if the seams are sealed. This is usually a mid-cost sheet insulation material. See Photo 3.

Polyisocyanurate (Polyiso or ISO) and Polyurethane sheets are usually orange or yellow. This insulation has a net R-value of about 6 per inch, after allowing for the common R-value reduction as it ages. These materials must be applied against a substrate such as foil to form a rigid sheet. When foil-faced, these materials are Class I vapor retarders and are air barriers if the seams are sealed. These are usually the highest-cost sheet insulation materials.

Polyiso and Polyurethane are also available as spray-applied insulation (spray foam). Spray foam comes in two flavors: open-cell (½ pound) and closed-cell (2 pound). Open cell has an R-value of about 3.7 per inch and closed-cell has an R-value of about 6.0 per inch. Both are good air barriers. Open-cell is not a vapor retarder and will admit liquid water. Closed-cell is either a Class II or a Class I vapor retarder, depending on the thickness, and resists liquid water intrusion.

The Bottom Line

The Word believes that closed attics and especially closed crawlspaces are the best ways to deal with these spaces. Assuming that The Word is correct (not always a good assumption), we'll see more plastic building material as we perform our inspections. This material can be a significant fire hazard if installed incorrectly. It is a good service to alert our clients about this material and about its risks if not properly installed.

Memo to Vulcan, god of fire: The Word does not reside on Mt. Olympus (just at its base) and welcomes other viewpoints. Send your lightning bolts or emails to Bruce@DreamHomeConsultants.com.
The Word thanks firefighter Matt Jacoby for reviewing this article.

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