

Green Science Policy Institute and BuildingGreen

Halogenated Flame Retardants (HFR) and Board Insulation

	Product	Form	Cost	R- value / inch	Raw Materials	Health Issues	Fire Retardant	Water Resistant	Embodied Energy
CONTAIN HFR	Extruded Polystyrene (XPS)	Boardstock	\$\$	5.0	Refined petroleum + blowing agent (HFC-134a); 15% recycled XPS	HBCD Flame Retardant, CO, Soot, Smoke, benzene	2.5% HBCD	Yes	High
	Expanded Polystyrene (EPS)	Boardstock	\$\$	3.5 – 4.0	Refined petroleum + blowing agent (pentane); 60% recycled EPS	HBCD Flame Retardant, CO, Soot, Smoke, benzene	0.7% HBCD	Yes	High
	Polyisocyanurate	Boardstock	\$\$	6.0 – 6.5	Refined petroleum + blowing agent (pentane); 10% recycled polyiso	CO, Soot, Smoke, Halogenated Flame Retardants	5-10% TCPP	Yes	High
	Spray Polyurethane Foam	Foamed-on (closed-cell or open-cell)	\$\$	3.6 – 6.0	Refined petroleum + blowing agent (HFC-245fa); 25% soy oil	Toxic during installation, CO, Soot, Smoke, Halogenated Flame Retardants	1-10% TCPP	Yes	High
DO NOT CONTAIN HFR	Perlite	Board	\$	2.7	perlite, cellulose binders, and waterproofing agents	No known issues	None	Yes	Low
	Mineral Wool (rockwool, slagwool)	Batt or boardstock	\$\$	4.2	Slag wool fiber and/or basaltic rock, phenolic resin	Can irritate and congest lungs during installation	None	Yes	Low (waste product)
	Cellular Glass	Boardstock and specially formed	\$\$\$	3.45	Alumino-silicate cellular glass with a specially elaborated composition; totally inorganic; contains no binders	No known issues	None	Yes	High
	Aerogel	Batt	\$\$\$	10.0	Silica gel, PET, fiberglass	Can irritate and congest lungs during installation?	None	Yes	High
	Microporous silica and carbon foam	Boardstock	\$\$\$	6.9 – 10	Silica or calcined coke	No known issues	None	Yes	Varied
	Expanded cork	Boardstock	\$\$\$	3.6	Natural cork (bark from cork oak, <i>Quercus suber</i>)	No known issues	None	Moderate	Moderate (shipping)
	Vacuum panel	Boardstock	\$\$\$	14 – 30	Silica or carbon substrate; foil facing	No known issues	None	Yes	Unknown
	Agrifiber	Boardstock	\$\$	3.0	Rice hulls, mycelium roots, wheat or rice straw	No known issues	Borate	No	Low
	Cementitious foam	Foam	\$\$	3.9	Magnesium oxychloride cement	No known issues	None	Yes	High

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Material	Example Product(s)	Typical Sizes / Uses	Website
Perlite	GAF EnergyGuard Perlite board Koppers Perlite Roof Insulation	Loose fill in cavities (roofs, walls, underslab), mixed with concrete (poured in, CMU), board: ¾", 1", 1.5", 2" TH, 2'x4', 4'x4'	www.gaf.com www.koppers.com/roofing/roofperl.htm
Mineral Wool (aka Rockwool)	Thermafiber Rainbarrier Roxul Board Insulation	Underslab, roofs, rainscreen 1"-6" thickness, 16"/24"/36" width, 48"/60" length; various densities	thermafiber.com www.roxul.com
Cellular glass	Pittsburgh Corning Foamglas Insulation	Boardstock and specialized product for pipe, conduit, ducting; thickness 1.5"-6"; 18 x 24" panels (tapered opt'l). Adequate compressive strength for sub-slab	www.foamglas.com
Aerogel	ThermaRock (bonded to GWB) Aspen Aerogels Spaceloft Insulation Cabot Corporation	Underfloor, rainscreen, roofs, interior walls 1/8", ¼", 3/8", 57" wide roll; granular also available	www.aerogel.com www.cabot-corp.com
Microporous silica and carbon foam	Microtherm Panel from Promat/Microtherm Group Koppers Kfoam Grafoam	High-temperature applications and panel products (including vacuum-sealed to boost R-value); specialized uses, including aeronautics, marine, energy industry	www.microthermgroup.com www.kfoam.com www.graftech.com/products/carbon-foam.aspx
Expanded cork	Amorim Isolamentos	Thicknesses from 1/2" to 12" in slabs approximately 24" x 36" available square-edge or notched for lapping	www.bcork.amorim.com/en
Vacuum panel	Dow Corning NanoPore Thermal Insulation HP	1" thick. 2' x 4' panels (Dow Corning) Custom (NanoPore)	www.dowcorning.com www.nanopore.com
Agrifiber	Agriboard SIP	Structural Insulated Panel: 4-3/8", 7-7/8" TH, 8-9'L, 8'-24'H	www.agriboard.com
Cementitious foam	Air Krete	Masonry cavity fill, stud cavities; foamed in place	www.airkrete.com