ROCK WOOL

APPLICATIONS

- thermal and acoustic insulation
- fire protection
- technical insulation
- packaging

PRODUCTION PROCESS

The most important natural resources for the production of rock wool are dolomite, basalt, and limestone. Stones are liquified in a smelting furnace at approximately 1500 ºC, spun into fibres, impregnated and hardened in a special furnace. Coke is the typical fuel for melting.

MAIN ENVIRONMENTAL IMPACTS

Main inputs are basalt, dolomite, limestone, cement and binders, such as phenol resin and formaldehyde resin. Production waste is usually recycled in the process. The energy demand for melting the raw materials is relatively high. Emissions are mostly caused by the heating process (e.g. dust, CO, CO_2, SO_2, NOx, ammonia, heavy metals, hydrogen fluoride, phenol, formaldehyde) and the upstream processes of extracting limestone, dolomite etc. Also the transport of coke is also can be relevant. At the end of its lifetime the material can be reused or recycled.

MATERIALS

TECHNICAL DATA	
Thermal conductivity (W/mK)	0,039
Density (kg/ m^3)	28

TECHNICAL PROPERTIES

- fire resistant
- good thermal properties
- high vapour transmittance
- does not rot

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MINERAL GLASS WOOL

APPLICATIONS

- thermal and acoustic insulation
- fire protection
- technical insulation
- packaging

PRODUCTION PROCESS

The most important natural resources for the production of glass wool are siliceous sand, soda. dolomite, clay, waste glass, borax and phenolic resin. Raw materials are melted in a furnace at a temperature of 1200 -1300 ºC. The melt is stabilized and guided through a nozzle into a centrifugal rotor, where the glass is firmed in fibres (fibrization process), wetted with liquid binder (impregnation) and formed in the crude blanket. This is followed by a process of water evaporation and binder polymerization under the influence of high temperature in the hardening chamber (polymerization process), after which the product gets an adequate shape. The products are produced in the form of fleece, (lower density) or boards. The main energy sources are natural gas and electricity.

MAIN ENVIRONMENTAL IMPACTS

Main inputs are sand, limestone, dolomite, recycled glass, chemicals (sodium carbonate, etc.), binders (phenol, formaldehyde and urea). The fossil energy demand for the production of glass wool is higher than that of rock wool, mostly due to the high amount of binder and the greater electricity need. The emissions are caused by the heating process (e.g. phenol, formaldehyde, ammonia, fluorine) and the electricity production. The properties of glass wool are similar to rock wool: good insulation capacities, non-combustible, , reuse and recycle is possible.
The manufacturing step has the highest contribution to GWP followed by the stage of raw material extraction and processing
The use of recycled glass as a raw material is gaining in importance, its share can be as high as 70 %.

MATERIALS

TECHNICAL DATA	
Thermal conductivity (W/mK)	0,032- 0,04
Density (kg/ m^3)	10

TECHNICAL PROPERTIES

- fire resistant
- good thermal properties
- high vapour transmittance
- does not rot

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EXTRUDED POLYSTYRENE FOAM (XPS)

APPLICATIONS

- thermal and acoustic insulation
- packaging

PRODUCTION PROCESS

XPS foams are mostly made of Polystyrene (90 to 95% by weight), blown with HCFC or with carbon dioxide and halogen-free co-blowing agents. The polystyrene granulate is extruded to plates under pressure in a special extruder.
Raw materials are melted in a furnace at a temperature of 1200 - 1300 ºC. Polystyrene is produced from oil and gas therefore it is linked to the availability of these raw materials. XPS is produced by a continuous extrusion process using electricity as the main power source: polystyrene granules are melted in an extruder and a blowing agent is injected into the extruder under high pressure.

MAIN ENVIRONMENTAL IMPACTS

Polystyrene is produced from fossil, non-renewable resources, such as oil and natural gas. The energy and chemical demand of the production is high. Boards with CO_2 (instead of HCFC) contribute to a lower global warming potential, but their thermal insulation properties are reduced from a certain thickness. The life span of the material itself is very long, but the expected life time depends on the building construction. If not glued or polluted, XPS can be reused or recycled. The material has a heating value, which can be thermally utilised.
Most of XPS foams off-grade material or scrap from production is recycled in the production process of XPS.

MATERIALS

TECHNICAL DATA	
Thermal conductivity	0,025 – 0,04
Density (kg/ m^3)	20-65

TECHNICAL PROPERTIES

- XPS is not sensitive to moisture,
- the water absorption is insignificant

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EXPANDED POLYSTYRENE FOAM (EPS)

MATERIALS

APPLICATIONS

- thermal and acoustic insulation
- packaging

PRODUCTION PROCESS

EPS foams are mostly made of Polystyrene (90 to 95% by weight), blown with carbon dioxide and halogen-free co-blowing agents. Raw materials are melted in a furnace at a temperature of 1200 -1300 ºC. Polystyrene is produced from oil and gas therefore it is linked to the availability of these raw materials.
The foam is produced by thermoforming of expandable polystyrene, during which the pentane blowing agent evaporates and builds the foam.
Graphite is used as additive (grey EPS) because it reduces the amount of radiant heat that moves through EPS. The result is that it can significantly reduce the heat transfer through the material.

MAIN ENVIRONMENTAL IMPACTS

The most important impacts are due to the processing of oil and pentan emissions from the thermoforming. Polystyrene has good insulating properties; its moisture resistance is high. It is a flammable material and styrol is emitted if it burns. The life time of the material is long; the overall life time of the construction depends on the system characteristics. It does not degrade biologically but clean expanded polystyrene has a potential for reuse and recycling.

TECHNICAL DATA

Thermal conductivity (W/mK)	0,03 – 0,041
Density (kg/ m^3)	10 – 50

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IS-SusCon

FOAM GLASS

APPLICATIONS

- thermal insulation of buildings and pipes
- insulation material with closed cells and low thermal conductivity due to the enclosed gas

PRODUCTION PROCESS

Foam glass is available in slab form, and is made from pure glass with gas-filled bubbles. The bubbles are formed by adding carbon to the glass melt, which reacts to form CO2, that largely remains trapped in the bubbles.
Melting at 1100 °C, forming, cooling down, smashing, crushing, mixing with carbon powder, foaming by heating in a mould (700-1000 °C), cooling, cutting to slabs.

MAIN ENVIRONMENTAL IMPACTS

Main raw materials are sand, limestone, coal powder and waste glass (almost 40 %). Natural gas and electricity are the most important energy carriers. Main emission is dust and the emissions from the thermal energy generation. Some solid waste is generated. Recyclable in granulate form.

MATERIALS

TECHNICAL DATA

Thermal conductivity (W/mK)	0,03- 0,041
Density (kg/m^3)	20 – 50

TECHNICAL PROPERTIES

- zero vapour permeability
- high dimensional stability
- lightweight, rigid, and durable
- resistance to chemicals
- non-combustible.

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CELLULOSE FIBRE INSULATION

APPLICATIONS

inflatable insulation of

- mainly horizontal surfaces
- non-load bearing slabs
- hidden, inaccessible structural parts

PRODUCTION PROCESS

The raw material for cellulose insulation is untreated, used newspaper. The production process starts with sorting, then the raw material is first taken to a cleaning cabin where it is cleaned of foreign materials and sterilized. Metals (e.g. paper clips) are removed using electromagnets. The cleaned material is then sent to the grinding mill, where first coarse and then fine grinding takes place. It is important that the grinding is as thorough as possible, as the size and air retention capacity of the pulp fibre will affect its subsequent decomposition and heat conductivity.The next step is to add additives (borax, boron salt and phosphates) to the ground, flaked raw material. This is necessary for fire safety reasons and to protect the material from rodents, insects, fungi and other pests. The final stage is packaging, where the finished insulation material is put into plastic bags.

MAIN ENVIRONMENTAL IMPACTS

Cellulose fibre insulation has a low embodied energy compared to other insulants. If fungicides and pesticides are added to cellulose fibres then these may present toxicity problems. Borax is moderately toxic but is usually considered an environmentally acceptable pesticide.

MATERIALS

Source: http://thermoflocinfo.hu

TECHNICAL DATA	
Thermal conductivity (W/mK)	0,035
Density (kg/ m^3)	40

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WOOD-WOOL INSULATION

APPLICATIONS

- simple insulation of partial facades
- thermal insulation of facades
- build-in roofs, partition walls, lightweight floor constructions
- acoustic suspended ceilings

PRODUCTION PROCESS

The basic ingredients for wood-wool insulation are wood, cement, water and a small amount of saline. The logs are sawn into planks (10 x 16 x 6 cm) and then sliced into 0,2-0,8 mm thick, 3-5 mm wide and 60-100 mm long fibres. After the chopping operation, they are dried to a moisture content of 12% to prevent fungal growth and then immersed in a saline solution containing an additive.

Wet wood wool that has been treated with saline is loaded into a blender and the binder, which can be Portland cement or magnesite (magnesium oxide), is added. It can be distinguished by its color because cement-bonded wood wool is gray and magnesite-bonded wood wool is white. White cement can rarely be used as a binder to preserve the natural color of the wood. The ratio of cement - wood-water is 4: 4: 1. The amount of aggregate must be given in relation to the amount of cement.

The final mixture is divided into three parts and then poured into a mold in three layers, making sure that the wood wool fibers are perpendicular to each other in every layer.

They are then pressed at room temperature for 8 hours at a pressure of 4 MPa, rested until the cement is set, then cut with a circular saw and placed in a pile. They are individually loaded and compressed and then stored at 20 ± 1 °C and 65 ± 2% relative humidity until the cement hardens (28 days). Finally, they are cut to the desired size and the molds are cleaned.

MAIN ENVIRONMENTAL IMPACTS

The raw material for wood-wool boards is likely to be waste from other wood processes, but these products offer little potential for recycle or reuse.

The need for cement or magnesite components increases the overall environmental impact.

MATERIALS

TECHNICAL DATA	
Thermal conductivity (W/mK)	0,070 – 0,090
Density (kg/ m^3)	250 - 450

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PUR THERMAL INSULATION

APPLICATIONS

- thermal insulation of roofs, high roofs, attics
- in panel or sprayed version

PRODUCTION PROCESS

Liquid raw materials stored in stainless steel tanks are passed through a pipeline to a heat exchanger. Passing through the heat exchanger, the polymerization process takes place and the liquid polyurethane gets into the dosing head via a dosing tube.
The next step of the manufacturing is to apply the liquid polyurethane to the laminate. At this stage, a conveyor belt passes under the dosing head, on which a lower laminating layer (eg glass veil, aluminum foil) was laid in advance.
As the laminating material passes under the dosing head, the liquid polyurethane is sprayed onto it. During spraying, the polyurethane encounters the carbon dioxide of the air, causing it to swell. Once the foaming process has begun, the upper laminating layer is applied by some rollers. The rigid foam is then passed through a line of leveling rollers that check and adjust the final thickness and shape of the product.

MAIN ENVIRONMENTAL IMPACTS

PUR can be recycled. Alternatively its energy can be recovered.
When burning, sooty products, water vapour, carbon monoxide, carbon dioxide, nitrogen oxides, as well as traces of hydrogen cyanide are formed. Polyurethane insulating material shall not be disposed of without prior treatment.
Within the impact category Global Warming Potential (GWP), isocyanate has a significant effect (approx. 50 %) while polyols and flame retardants only have a moderate share in the overall result (approx. 10 %, respectively).

MATERIALS

Source: https://www.proidea.hu/sajtokozlemenyek-6/bachl-tecta-pur-had-plus-tetofelujitas-15575.shtml

TECHNICAL DATA	
Thermal conductivity (W/mK)	0,022-0,030
Density (kg/ m^3)	30-100

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STRAW INSULATION

APPLICATIONS

- non-load-bearing walls
- wall, slab and roof insulation

PRODUCTION PROCESS

The straw is baled in different sizes and shapes. In terms of tying bales for construction, we distinguish between two-wire and three-wire log bales. Dimensions of straw baling (two-wire) for construction: 32-44 x 50 x 50-120 cm, from which a 50 cm thick wall can be laid. The average length is between 80 and 90 cm, which is mainly due to the fact that smaller balers are no longer produced today. 40 x 50 x 80 cm bales are the most common ones in Hungary.
For use in construction it is important that the bales are as dense and compacted as possible. The weight of the bales is between 15-30 kg. The straw bales are clamped with wire. The material of the wires can be polypropylene, natural hemp, as well as metal wire. The advantage of the latter is that it keeps the bale together even in the event of a fire, as it is not damaged even at high temperatures.
The moisture content of the construction bale must be less than 15 m / m%. At the construction site the bales must be covered, protected from any moisture, and lateral ventilation must be provided.

MAIN ENVIRONMENTAL IMPACTS

It is characterized by a long service life. The straw is not exposed to any harmful effects under the clay plaster. Today, straw bale architecture dates back 150 years. The oldest houses which are still standing today are over 100 years old.
It is a degradable material. After the buildings are demolished, the straw can be returned to the natural cycle without any treatment. Disposal and dumping of the other insulation materials used today, on the other hand, means waste disposal task and a cost. In a life cycle perspective, the agricultural activities related to the production of straw can potentially have significant impacts (e.g. eutrophication).

MATERIALS

Source: https://epiteszforum.hu/egy-megepithetetlen-haz-sikere-brusszelben

TECHNICAL DATA	
Thermal conductivity (W/mK)	0,045-0,06
Density (kg/ m^3)	80-120

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