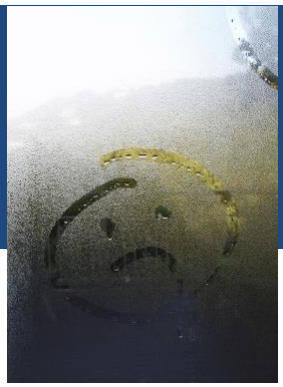
Breathing Houses



What is a Breathing House?

A breathing house has a structure that can allow internal and external air and water vapour to diffuse through it, keeping the materials dry, as well as allowing it to dry out quickly if there is a roof leak, flood or burst pipe. If a moisture build-up doesn't dry out within 24-48 hours, then potentially harmful mould can develop and remain. A dry structure will also reduce exposure to electro-magnetic radiation.

A breathing structure is most easily created in the walls, but it is also possible to create breathing floors and roofs.

Principles of a Breathing Structure

People tend to think that keeping water out of a building is best done by sealing it completely, but creating a perfect seal is virtually impossible. In fact, there is a high chance of there being minute cracks and holes that actually draw moisture in through capillary action or wicking. Larger gaps and pores actually create a pressure drop and stop the wicking process.

Choosing a material that has a high proportion of larger pores will help prevent wicking, and building in gaps to create a capillary break in the structure is an added safeguard. Then the water can either be drained away or evaporate and move out of the wall again.

What about Thermal Performance?

The thermal performance of a building can be improved by reducing uncontrollable air infiltration, which is the air leakage between separate pieces of material.

Air diffusion through a material takes longer and as it gradually warms or cools in that time it does not present a significant thermal loss. Breathability is not inconsistent with high thermal performance.

Does it Cost a lot More?

In a new home, 90% of installed materials are in the building envelope (floors, walls, and roof, and excluding doors, windows and finishes). This 90% represents less than 20% of the total construction cost, and less than 10% for the material cost.

> *"Typically you can eliminate nearly all the toxins of this 90% bulk component by spending an additional amount that raises the total cost of construction by only a few percent. On the other hand, getting all of the last 10% of the toxins out of your building could easily double its cost!"* - George Swanson

Creating a Breathing Roof

The primary objective of a roof is to keep water out, but using materials that breathe can still do this. Clay tiles and shingles are both slightly porous materials, but will dry out again with intermittent rain. The gaps between the tiles aid this process and help release any internal moisture vapour. Clay tiles can be glazed for added protection. A breathable building wrap underneath also prevents any exterior moisture dripping into the ceiling space. However, in an area of

high wind driven rain, a sheet roofing material is better protection and breathability is better achieved in the wall structure.

Creating a Breathing Floor

For a timber floor, instead of using particle board sheets, lay good quality Magnesium Oxide ($MgS0_4$) boards on to the joists. Maglok Dragonboard is 20mm thick and suited for timber floors. $MgSO_4$ is a breathable material with many excellent qualities including rot, mould, fire and water resistance. It also captures CO_2 during production and uses much less energy to produce than Portland cement or slaked lime.

Sheets of $MgSO_4$ can also be laid on top of a concrete slab floor, and by keeping drier than the concrete underneath, they can reduce mould and electro-magnetic field build-up inside.

To create a breathing slab on its own involves eliminating the vapour barrier, which can be done by raising the floor well above the water table and creating a capillary break underneath the slab using coarse gravel, as well as having good drainage. Alternatively, a system with a dimpled plastic mat, Delta Drain, and a geotextile fabric is a way of providing a vapour barrier with large enough air pockets to reduce mould formation.

Creating Breathing Walls

A light timber frame breathing wall can be achieved by putting a layer of $MGS0_4$ board to either side of the timber framing. No gib board is required inside. Outside, the boards need to be protected from excessive moisture, so a cavity system is required with battens and a waterproof cladding. The $MGS0_4$ board serves instead of plywood in the cavity system.

It is important that good quality, industry accredited boards are used, as cheap ones with less $MGSO_4$ have been known to fail by absorbing too much moisture and by not having any fibre reinforcing mesh.

For a thermally massive wall, there are good products, but they need to be imported.

Durisol is a cement impregnated wood fibre concrete form in the shape of a concrete block. The holes are filled with reinforced concrete. In combination with a water-proofing mortar layer and the Delta Drain matting, it can be used below grade and still breathe sufficiently to avoid mould build-up without letting in moisture from the ground behind it.

Porotherm fired clay construction blocks are a great alternative for above grade walls, instead of concrete blocks.

Woodtex panels are made from wood-wool and Portland cement, and has good insulation properties so can be used as a cladding to a thermally massive wall. If used outside, a cavity is recommended to ensure the material is able to dry out. It provides a good surface for natural plaster/stucco finishes. It can also be used for below slab insulation, either as panels or crushed pieces.