ASBP The Alliance for Sustainable Building Products

Is Breathability Really that Important?

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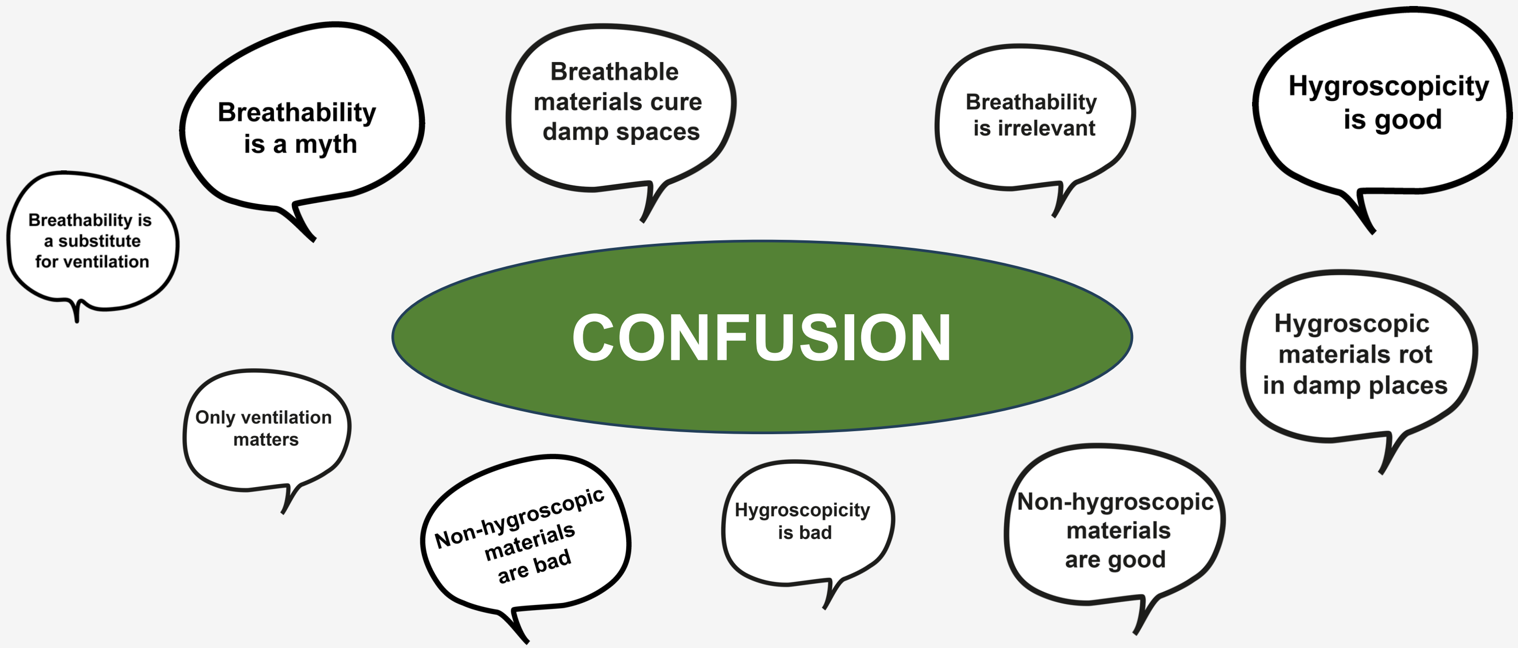
NATURAL FIBRE INSULATION GROUP

The Challenge with Breathability



Need to understand:

- What breathability is and what it does within the building context.
- What Building Regulations and standards say about it.
- What hygroscopicity is and its role in moisture buffering (important for NFI).

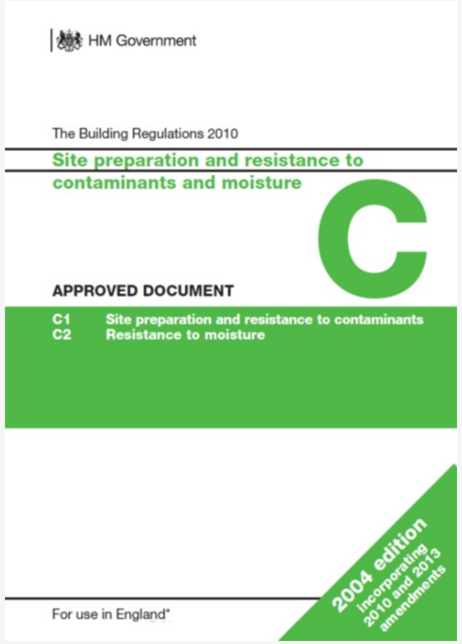
What is Breathability

- A system that allows the safe transmission and removal of excess water vapour.
- Needs moisture limiters, pathways and buffers to function most effectively.
- Allows for the unventilated dispersal and removal of water vapour from within the building fabric preventing the accumulation of harmful water and persistently high humidity.
- Principally provides a means of mitigating the risk of interstitial condensation, i.e. condensation within the building fabric.
- Provides a marginal benefit in mitigating surface condensation risk (primarily driven by internal humidity, ventilation and surface temperature).
- Breathability is not a substitute for ventilation.
- Breathability is recognised in building regulations.

Aspects of Breathability

- **Limiters** – Could include AVCL such as intelligent membranes, positioning components according to vapour resistance and limiting voids. Prevents moisture over-loading and bottlenecks.
- **Pathways** – Requires higher degrees of vapour openness. Provides a means of egress for water vapour and prevents moisture over-loading and bottlenecks.
- **Buffers** – Requires certain types of hygroscopicity. Provides a means of dampening fluctuations in humidity and storing water in a safe form during transient periods of high humidity.

Building Regulations – Part L (Energy) & Part C (Moisture)



How Part L Interacts with Part C

0.20 *This approved document, Approved Document L, Volume 1, provides guidance and examples on upgrading thermal elements. For interstitial and surface condensation, a lesser standard may be acceptable. Guidance in Approved Document C should be followed.*

Appendix C: Work to thermal elements

*Assess condensation risk in roof space and make appropriate provision in accordance with the requirements of Part C relating to the control of condensation (**BS 5250** and **BS EN ISO 13788**).*

British Standard – BS5250:2021

Recommendations for the management of moisture in buildings using an integrated and pragmatic approach.

This includes the management of moisture risk from interstitial and surface condensation, from too high or too low internal relative humidity, and from rain penetration or high levels of ground water.

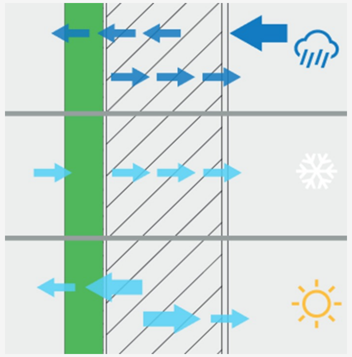
States of water as gas, liquid and solid, and the interactions between these states. Although it doesn't explain 'bound water'.

Describes the principal sources of moisture in buildings, its transportation and deposition and provides recommendations and guidance on how to manage those risks during the assessment, design, construction and operation of buildings.

Includes BS EN 15026 for condensation risk assessment (dynamic modelling) in addition to BS EN ISO 13788 (steady state modelling).

Is Breathability Needed?

- BS EN ISO 13788 condensation risk analysis assumes a steady state in the building fabric, but the building fabric is not in a steady state.
- Building fabrics are dynamic. Factors that influence ongoing humidity within the fabric include:
  - Air movement/air flow
  - Interfaces & junctions
  - Solar & long wave radiation
  - Precipitation, wind speed & direction
  - Moisture in materials & rainwater absorbed during construction



- BS EN 15026 non-steady state modelling incorporates most of the above.
- Through a set of limiters, pathways and buffers we can naturally regulate humidity levels within the fabric.

BUILDING FABRICS HAVE DYNAMIC HUMIDITIES, WE CAN'T RELY ON AVCL ALONE TO MINIMISE CONDENSATION RISK – WE NEED ADDITIONAL MEANS INCLUDING BREATHABILITY

BS5250 – D.3 Movement of moisture within structures

Moisture moves within a building structure by a combination of vapour diffusion, liquid flow through material pores and air movement through gaps, penetrations and cavities.

Water vapour diffuses through most building materials, the rate of diffusion being dependent upon the difference in vapour pressure between inside and outside and the vapour resistance of each layer of material in the construction.

Many materials are porous and absorb moisture from the air at a rate that depends on the ambient relative humidity. They can also absorb water from driving rain on the outside surface, and contain large amounts of water included during construction. This water then moves through the structure under relative humidity gradients.

During the winter, heat and moisture are generated within the building, raising the internal temperature and vapour pressure above the outside causing water vapour to diffuse outwards.

However, solar gain on the outside, especially on south facing walls, can cause moisture to move inwards through the pores.

Wind acting upon a building produces, on the leeward side, a negative pressure zone. Also, higher internal temperatures in cold weather increase the air pressure in the upper storeys inside the building relative to the outside leading to a circulation of air through the building (commonly called stack effect). Both these processes drive air carrying water vapour through the gaps and cracks in the structure. It is important to recognize that the rate at which moisture is transported by air movement, where it occurs, is much greater than the rate of transportation by diffusion.

Breathability – Moisture Buffering

BS5250 – What it Says About Hygroscopicity

Hygroscopic materials can be beneficial….

D.4 Hygroscopic materials

Most materials are hygroscopic (able to absorb and desorb water vapour). This can have a beneficial buffering effect, reducing the risk of both surface and interstitial condensation during rapid fluctuations of temperature and vapour pressure. However, hygroscopic materials exposed to high levels of humidity can, over time, absorb sufficient moisture to cause damage to elements of structure, to finishes, to furniture and to furnishings.

…providing we avoid conditions of persistently high humidity

Hygroscopicity – Good or Bad?

BS5250 – treats hygroscopicity as a single factor.

Hygroscopicity is not a quantitative definition so whether hygroscopicity is good or bad depends on the degree and type of hygroscopicity and how and where a material is used.

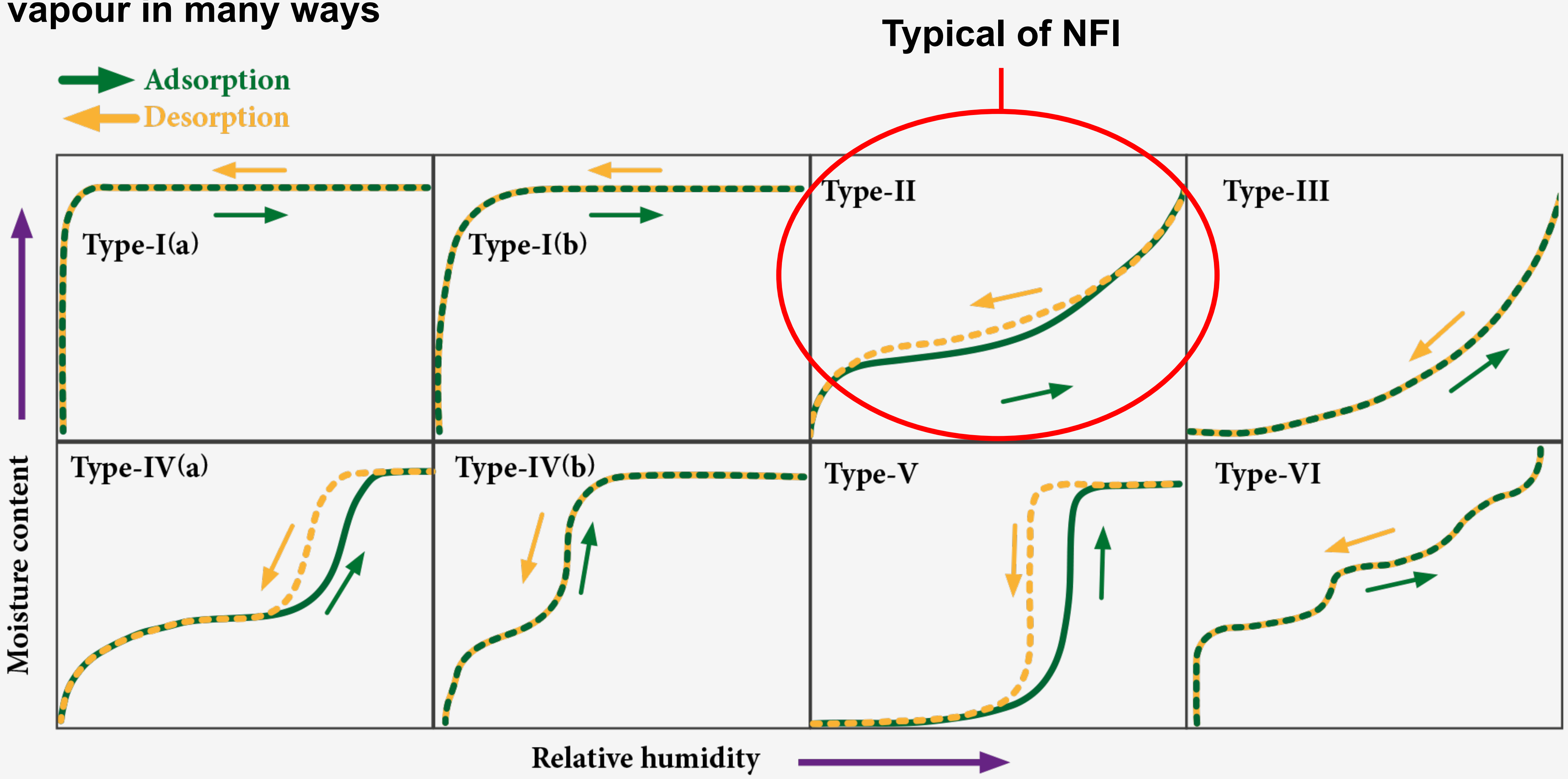
Describing something as hygroscopic is like describing something as heavy or light. It means nothing without context. We need more consideration in the language.

We need to understand the degree and manner of hygroscopicity for a given material.

Hygroscopic Classification	Mass gain at 24h @ 25^{o}C & 80% RH
Slightly hygroscopic	<2% and ≥ 0.2%
Hygroscopic	<15% and ≥ 2%
Very hygroscopic	≥ 15%
Deliquescent	Forms a Liquid

Water Sorption Isotherms

Hygroscopic materials adsorb water vapour in many ways



Takeaways

- Breathability is primarily a measure to help mitigate the risk of interstitial condensation.
- Breathability is not a substitute for ventilation.
- Existing regulations and standards provide opportunities to use breathability.
- Hygroscopicity is essential for moisture buffering but it is not a single entity, it has degrees and forms.

Breathability really is that important ✔

Thank you

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