Evaluation of an interior air barrier system with dynamic water vapour control
Guillaume Pandraud
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Introduction

- Saint-Gobain ISOVER and airtightness solutions
  - SG ISOVER, a producer of mineral wool?
  - ISOVER presents itself as an expert of energy performance and comfort
  - ISOVER solutions for airtightness and moisture control
    - Ex: Vario range
  - ISOVER Vario: a complete system
    - Membrane
    - Tapes
    - Sealant
    - Special components
  - Necessity: product characterization
ISOVER characterization facilities

3 Laboratories
- France, CRIR (near Paris; manager GP)
- Ladenburg, Germany
- Blue Bell, PA, USA

Measurements in CRIR lab
- Metrology
  - Calibrations
  - Study of the influence of different parameters on the measured results
  - Link with standardization work

- Internal and external benchmarks
  - Comparisons of methods and results
  - Other SG labs for best practice exchanges
  - Reference institutes, suppliers…

- Characterization
  - ISOVER products
  - Competitors watch
ISOVER characterization facilities

- **Equipment in CRIR: 3 main types of tests**
  - Mechanical strength
    - Use of a traction machine
    - Membrane traction strength and nail tear strength
    - Shearing and peeling strength of adhesives
  - Airtightness
    - Airtightness system characterization setup
    - In situ measurements (Blower Door, IsoV'Air test)
  - Water permeability
    - Measurement of $S_d$ values
  - + Others...
    - Ageing
      - Oven, climatic chamber, UV test
    - “Exceptional” measurements
      - Mechanical resistance of metallic fixations
    - ...

Examples of applications: Adhesives quality control

- **ISOVER adhesives must be controlled before being sold**
  - Control must be on par with certification organisms
  - Checking the metrology by successive internal and external comparisons

- **Some of the parameters whose influence has been checked**
  - Machine speed (very high)
  - Room temperature and humidity (high)
  - Direction in which the membrane is cut (moderate)
  - Material on the machine grip (moderate)
  - Number of days before the test (low)
  - Method and weight used to press the adhesives (low)
  - Sensor sensibility (negligible)
  - ...

- **Even following standards to the letter, there is room for differences**
  - Importance of communication, standardization, exchange of best practices
Examples of applications: Integra₂

► Integra₂ fixations development
  ● Customer: ISOVER France
  ● Objective: define components geometry
  ● Action: control leakages

► Activity
  ● Device construction
    ▪ Check suspensions in real conditions
    ▪ Sample under depression
    ▪ Flow rate control
  ● Setup calculation method (EN12114)
    ▪ \[ V = C \Delta p^n \]
  ● Calculate leakages at 4 Pa and 50 Pa

Examples of applications: Integra₂

► Progressive reduction of leakages (by about 95% eventually)
  ● Validated by measurements at CSTB: no leakage with 64 fixations
Examples of applications: Vario Xtra

- **Vario is a Smart Vapor Retarder**
  - Humidity-dependant moisture diffusion
    - Higher at low humidities (usually in winter)
  - Variable Sd value (equivalent air layer thickness)
    - Prevents moisture condensation in winter (low Sd values)
    - Allows moisture dry out in summer

![Graph showing Sd values at different humidity levels]

- Technical validation of achieved solutions with WUFI program
  - Hygrothermal simulation software, couples heat and moisture transfer
  - Control: Study of R&D solutions when applied to real configurations
    - Hygrothermal analysis: heat flow and water/moisture content
    - Critical moisture conditions (punctual observation)
    - Microbial growth (moisture in wood < 20% @ T > 10°C)

- Some of the cases studied
  - Climates
    - Climate 1: Germany (Holzkirchen) – Continental - Central EU
    - Climate 2: France (Nancy) – Cold/humid winter – Extreme case
  - Construction modes
    - 1. Temperate application: Pitch roof – Climate 1
    - 2. Critical application: Green/flat roof – Climate 1
    - 3. Extreme critical application: Wooden frame house (1/3 - 2/3) – Climate 2

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Examples of applications: Vario Xtra

- Wufi output – Case 3 – Extreme conditions: out of Vario KM range
  - Wood frame house, North-oriented wall, shaded, Nancy climate
  - Results: water content in OSB after 5 years
    - Probable mould growth
    - Vario KM not prescribed for this combination of climate and construction type

Examples of applications: Vario Xtra

- Experimental and numerical study of a new prototype
  - Sd measurements of several prototypes, choice of the best one
  - Drawing of the Sd curves → inputs for Wufi model
  - Best prototype validated → Vario Xtra on the market
Conclusion

- Saint-Gobain ISOVER is the leader in Energy Efficiency of Buildings
- Importance of the quality of its solutions
  - Product development
  - Quality control
  - Standardization

- Common basis for these axes: a good metrology
  - Awareness of the importance of the metrological process
  - Improving constantly the metrology

- Perspective: Influence of the products ageing
  - How do different products react to high temperatures, humidity, cycles… ?
  - What tests are the more representative of reality?

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Traction machine

Airtightness characterization setup
Water vapour permeability