EmiratesGBC Technical Workshop
Sustainable Weather Seal Solutions for Construction
Understand the sealant types, weather seal sealant standard & testing methods

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Company
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Agenda

- History/Evolution
- Technical Properties & Sealant types
- Testing Standards
- Conclusion/Points to Remember
History and Evolution of Silicone Sealants

Ancient times: mud and clay
17th cent.: putty
1960s: Poly-Butyl, Poly-Urethane
1970s: Silicones
1990s: MS / STPE

to be continued……
What is the Basic use of a Sealant

- To fill gaps or holes?
  - Require optimum gap-filling functions only

- To seal two substrates together?
  - Require optimized adhesive properties

- To form protection barrier?
  - Good adhesion properties, flexible, No product degradation
Every Modern Building needs a Sealant

- Prevent damage of structures and contents due to water
  - Water must not come in from outside
  - Water must be kept in suitable areas inside the building

- Buildings always move due to thermal expansion, contraction and seismic loads
Other Reasons for having Sealants or Other Applications

- To conserve energy: Minimize unwanted airflow
- To improve aesthetic appearance and cleanability of interior surfaces
- To act as sound barrier: reduce sound transmission through cracks in interior and internal composite assemblies

Special Applications & as Adhesives
- Mirror Mounting
- Aquariums
- Fire Stopping
- Food Contact
## Various Sealant Types used for Different Applications

<table>
<thead>
<tr>
<th></th>
<th>Acrylic</th>
<th>Butyl</th>
<th>Urethane</th>
<th>Polysulfide</th>
<th>STPE / MS</th>
<th>Silicone</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td>• Easy to apply</td>
<td>• Very low gas / vapor permeability</td>
<td>• “Organophilic”</td>
<td>• Low cost</td>
<td>• “Organophilic”</td>
<td>• Durability</td>
</tr>
<tr>
<td></td>
<td>• Easy to clean</td>
<td>• Hydrophilic</td>
<td>• Paintable</td>
<td>• Solvent/fuel-resistant (low swelling)</td>
<td>• Hydrophilic</td>
<td>• Weatherability</td>
</tr>
<tr>
<td></td>
<td>• Low cost</td>
<td>• Chemical resistance</td>
<td>• Mechanical properties</td>
<td>• Chemical resistance</td>
<td>• Paintable</td>
<td>• UV-stability</td>
</tr>
<tr>
<td></td>
<td>• Paintable</td>
<td>• Elastic properties</td>
<td>• Abrasion resistant</td>
<td>• Low gas permeability</td>
<td>• Wet applicable</td>
<td>• Heat-resistance</td>
</tr>
<tr>
<td></td>
<td>• No harmful emission</td>
<td>• Low cost</td>
<td></td>
<td></td>
<td>• Adhesion range</td>
<td>• Flexible @ low temp.</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>• Dirt pick-up</td>
<td>• Low movement capability</td>
<td>• High modulus</td>
<td>• Bad odor</td>
<td>• Cost</td>
<td>• Not solvent resistant</td>
</tr>
<tr>
<td></td>
<td>• Limited thermal &amp; hydrolytic stability</td>
<td>• Limited durability</td>
<td>• UV stability</td>
<td>• Mostly 2-part</td>
<td>• UV stability</td>
<td>• Swelling</td>
</tr>
<tr>
<td></td>
<td>• Plastic deformation behavior</td>
<td>• Black coloured</td>
<td>• Limited adhesion to metals</td>
<td></td>
<td></td>
<td>• Not paintable</td>
</tr>
<tr>
<td></td>
<td>• Shrinkage &gt;20%</td>
<td></td>
<td>• Only dry applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Health hazard</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Cost</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Appl.</strong></td>
<td>• Gap filler</td>
<td>• IG (primary seal)</td>
<td>• Weatherseal</td>
<td>• Fuel-resistant appl. (e.g. ground joint at filling stations)</td>
<td>• Weatherseal</td>
<td>• Weatherseal</td>
</tr>
<tr>
<td></td>
<td>• Automotive</td>
<td>• Automotive</td>
<td>• Glazing</td>
<td>• IG (sec. seal)</td>
<td>• Automotive</td>
<td>• IG (sec. seal), SG</td>
</tr>
<tr>
<td></td>
<td>• Low cost housing</td>
<td>• Construction</td>
<td>• Automotive</td>
<td>• Aircraft sealant (heat resistance!)</td>
<td>• Construction</td>
<td>• Construction joints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ...</td>
<td>• Weatherseal</td>
<td>• Sanitary area</td>
<td>• Glazing</td>
<td>• Glazing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Road appl.</td>
<td></td>
<td></td>
<td>• Sanitary area</td>
</tr>
</tbody>
</table>
Silicone Sealants are Classified as per their Applications

<table>
<thead>
<tr>
<th>Category</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Façade</td>
<td>EN 15651-1, ISO 11600 F, SNJF F, ASTM C 920, BS 5889, DIN 18540</td>
</tr>
<tr>
<td>Glazing</td>
<td>EN 15651-2, ISO 11600 G, SNJF V, ASTM C 920, BS 5889, DIN 18545</td>
</tr>
<tr>
<td>Sanitary</td>
<td>EN 15651-3, ISO 846, Emicode</td>
</tr>
<tr>
<td>General Appl.</td>
<td>Emicode</td>
</tr>
</tbody>
</table>

Emirates Green Building Council

[Image]
Standards are followed for Weathersealing

ISO 11600
EN 15651 -1, -2, -4
ASTM C920
DIN 18540 / 18545
BS 5889

Requirements on sealants
- Broad adhesion profile
- High flexibility
- Fire resistance
- No harmful emissions
- High stability against aging (UV)

EN 13501-1, -2
DIN 4102-1
ASTM E814
BS 476-20
Mechanics - Classification Standards

ASTM C920
Class (100/50, 50/50, 35, 25, 12½)
The classifying test is done in accordance to
ASTM C 719 (Hockman cycle)
Repeating elongation/compression (10 times) after conditioning

EN 15651 / ISO 11600
Class (25, 20, 12½)
ISO 7389 (100% elong. for class 25)
ISO 8339 (100% elong. for class 25)
ISO 8340
ISO 10590 (100% elong. for class 25)
ISO 11431 (100% elong. for class 25)
ISO 9047 (25% cycling)
## Mechanics - Classification Standards

### Classification

Class (ISO 8339 / ISO 7389):
- **Extent. recovery**
  - 12.5 \(25\%\) \(>70\%\)
  - 20 \(60\%\) \(>70\%\)
  - 25 \(100\%\) \(>70\%\)

**Modulus (maximum extension)**
- LM <0.4 N/mm² < HM
Mechanical Requirements and Properties

- Requirements on silicone sealants

**Elongation**

**Compression**

**Shear**

- Joint width
- Joint depth
- Depth of the joint system
- Backing material

⇒ ratio of width : depth ca. 2 : 1
Complaint: Sealant has cracked

Back-up material should be used to prevent 3-side adhesion on surface

Joint Width Min. 6mm
Sealant Depth Min 3mm
Back-up material

2-side adhesion on surface

3-side adhesion on surface
Complaint: Sealant is peeling off or having a slump

Back-up material should be used to prevent 3-side adhesion on surface
Sealant Failure: Natural Stone & Tiles have stained

- Contaminated by silicone oil after full curing
- Can not be cleaned by solvent
- We are using special oil to prevent non-bleeding silicone
- Tested by ASTM C1248

Staining of a non-porous substrate

Staining of natural stone
Asking the right questions is very crucial!!

- Compare the values taken from the same measuring methods!
- Different test method will give different test results
- Right sealant for the right application!

<table>
<thead>
<tr>
<th></th>
<th>2 mm dumbbell (DIN 53504)</th>
<th>H-Specimen (ISO 8339)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulus 100%</td>
<td>0.31</td>
<td>0.37</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>1.98</td>
<td>0.77</td>
</tr>
<tr>
<td>Elongation at Break</td>
<td>693</td>
<td>327</td>
</tr>
</tbody>
</table>
Thank you for your attention!