GLASSTECH ASIA 2002 CONFERENCE

"NEW CHALLENGES AND OPPORTUNITIES WITH GLASS "

LONG TERM STABILITY OF LAMINATED SAFETY GLASS

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1. INTRODUCTION

Laminated architectural safety glass based on PVB has come a long way from its first use some 60 years ago. New applications have changed the architectural landscape and more and more high performance glazing materials are marketed. It is important to stress that the laminated safety glass process should be carried out by highly professional people at all stages. It is the aim of the presentation to contribute to a better understanding of the fundamentals of the laminating glass process. Quality requirements have to be clearly understood and are the key success for product performance, durability and credibility.

2.DIFFERENT TYPES OF GLAZING

The selection of glass for architectural/building applications is a very complex exercise. Some different types of glazing available :

- ordinary glass (float glass)
- wired glass
- tempered glass
- laminated glass
- laminated safety glass with PVB

We can see that laminated safety glass based on PVB is the preferred product by most of the architects and building specifiers for more than one reason.

- Safety : PVB interlayer absorbs the energy of human impact, if the glass breaks. The glass fragment remain bonded to the interlayer.

- Security : laminated safety glass resists intrusion of burglars and vandals.

- Sound reduction : the use of laminated glass with PVB already improves greatly the sound reduction behaviour of a glazing, a special TROSIFOL SC PVB with optimised damping properties is used for optimum sound attenuation.

- Solar control : the PVB interlayer screens out over 90 % of UV radiation.

3.MAJOR CONTRIBUTORS AND/OR INFLUENCING FACTORS FOR LONG TERM STABILITY OF LAMINATED SAFETY GLASS WITH PVB

a) polyvinylbutyral (PVB) interlayer

- the intrinsic adhesion level of PVB can vary from type to type. Most PVB producers offer PVB with low/medium/high adhesion level . Customers select type based on process conditions, applications and standards to be met.

- moisture content of PVB is a key element for adhesion and impact performance of the laminate. Suppliers deliver PVB at a specified moisture , this level should be maintained during the processing of the PVB.

- composition of PVB can also vary from type to type and application to application.

b) glass

Glass as well as PVB have factors/aspects that contribute to the long term stability of Laminated safety glass with PVB. Glass to be laminated could be annealed glass (Float Glass) as well as tempered glass as well as coated glass (pyrolytic, magnetron,organic). It is clear that each type of glass will behave different in the laminating process.

Studies reveal that the different glass suppliers produce totally different glass surfaces resulting in different adhesion levels.

Ageing as well as corrosion and contamination of the glass should be avoided.

Due to the float glass process glass will have 2 different sides : air side and tin side. Adhesion of the air/air laminate versus tin/tin laminate might give different adhesion pummel unit values.

Clean glass is needed for lamination: wash water quality should be monitored and maintained at 20 microS max.

c) laminating process

Each step in the laminating process influences the quality of the laminated glass. Expertise should be available to better understand process characteristics as well as influencing factors. Adhesion and long term stability go hand in hand.

Process steps :

- glass preparation
  - glass storage
  - glass cutting
  - glass washing
- PVB storage :
  - refrigerated PVB
  - interleaved PVB
- assembly :
  - glass and PVB sandwich
- de-airing :
  - nip roll process
  - vacuum de-airing - rubber ring process
    - vacuum bag process
- autoclaving
- inspection and testing

PVB DURABILITY – LONG TERM STABILITY TESTS

Industrial standard : adequate durability using 2 years actual outdoor exposures in both a high heat/high UV environment and a high heat/high humidity environment.

NATURAL OUT DOOR EXPOSURE

1. Arizona exposures

   - purpose : confirm chemistry stability upon extended exposure to high heat and solar radiation.
   - exposure time : 36 months
   - tests : visual inspection
     adhesion
     bake
     haze/colour change

2. Florida edge stability

   - purpose : evaluate the magnitude of edge defects created with exposure to high heat and humidity.
   - exposure time : 36 months
   - tests : delamination, edge whitening, bubbles, adhesion

3. EMMA exposure

   - purpose : confirm stable chemistry after accelerated exposure to high heat and solar radiation.
   - duration : 9 months
   - tests : visual inspection
     adhesion
     colour change

ACCELERATED EXPOSURE CONDITIONS

- humidity test (ECE 43)

  14 days 50 °C/98 % RH - 3 cycles
  14 days 23 °C/50 % RH - 3 cycles

- thermal cycling test

  16 HR 80 °C/98 % RH – 14 cycles
  8 HR 30 °C/78 % RH - 14 cycles

- Q.UV test

  16 HR UVA 60 °C - 3200 Hr
  8 HR condensation at 40 °C - 3200 Hr

d) Installation of laminated safety glass

- support : frame material is integral part of the laminate glazing system.

- It is a complex decision to select a sealant that best satisfies building project requirements. Sealant types include : urethane, butyl, acrylic, silicone. Each product is specifically formulated for some applications but not for others. Understanding those products is a critical requirement in making the overall sealant choice.

- Needless to say that laminated glass installation should be done by professional, reliable well trained people

4.SUMMARY

The world of glass becomes more and more complex! The need for architects and engineers specialists at each link of the chain (specifying, production, installation) as well as a close co-operation between : architects, structural engineers, building contractors, sealant manu-facturers will guarantee a bright future for laminated safety glass with PVB.

5.CONCLUSION

Laminated safety glass based on PVB is used for more than 60 years. Architect engineering offices are increasingly specifying laminated safety glass based on PVB for product durability as well as ageing and multifunctional performance.

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