POLYMER'S UV ACCELERATED AGEING TESTS : APPLICATION FOR ADHESIVES/SEALANTS

Ingénierie du Matériel
SNCF VOYAGEURS

SUMMARY

01.
PROBLEM

02.
LOOKING FOR A METHOD

03.
APPLICATION OF METHOD TO BAD RETURN OF EXPERIENCE

04.
APPLICATION OF METHOD FOR THE VALIDATION OF NEW BONDING APPLICATIONS

05.
CONCLUSION

01. PROBLEM

Bad behaviour on train

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01.
PROBLEM

SEALANT BREAKDOWN

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PROBLEM

Sealant PU1

PROBLEM

Sealant MS1

PROBLEM

Divers sealants

02. LOOKING FOR A METHOD

Why not apply the method used for painting?

02.
LOOKING FOR A METHOD

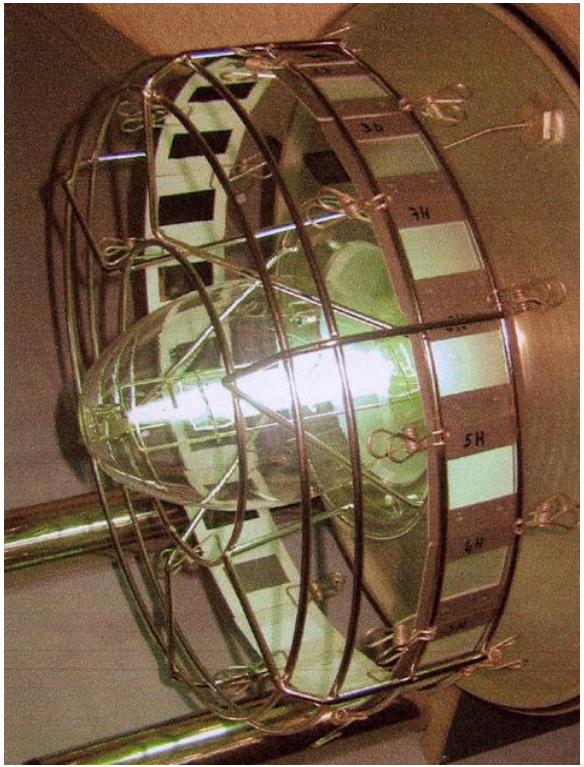
VALIDATION METHOD USED FOR PAINTING

METHOD USED FOR PAINTING

Painting Natural Ageing Tests (VN) on 4 French sites

METHOD USED FOR PAINTING

Accelerated ageing test « BANDOL WHEEL® » (test F 423 according with standard NF F 19-201)



- ✓ lluminant : mercury vapour bulb 400 W (radiation level UV of 120 W/m²)
- ✓ No length radiation up to 295 nm.
- ✓ Bulds used (according to NF EN 60188 standard) give benefits as following:
  - 3 times more efficient than a Xenon bulb;
  - insignificant UV C radiation;
  - balance UV A-UV B equivalent to the solar radiation at the surface of the Earth;
  - long lifetime without variation of the spectral distribution during all the life.

Correlation studies have shown that 3000 hours of « BANDOL WHEEL® », in dry mode, corresponds to 7 years of VN exposure in the most difficult sites (LE CROISIC & NÎMES)

02.
LOOKING FOR A METHOD

ADAPTING THE METHOD USED FOR PAINTING TO SEALANTS

VALIDATION METHOD FOR SEALANTS

Test conditions for validation

UV Ageing tests realised:

- **Dry « BANDOL WHEEL® »** exposure at 70°C for 3000 hours (test F 424 NF F 19-201) → Rollingstock Painting test
- **Humidity « BANDOL WHEEL® »** exposure at 50°C for 3000 hours with 30 % of time in hidden immersion.

Tests made before and after UV ageing tests:

- Hardness Shore A (ISO 868).
- Thickness (ISO 23529, micrometer).
- Pull off test (ISO 37, test sample type 2)
  - Strength value at 100 % elongation
  - Tensile Strength
  - Elongation value at break

Tests made with 3 sealants:

PU sealant: PU1

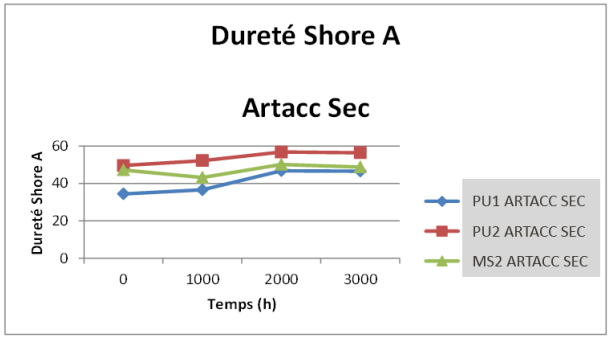
PU sealant : PU2

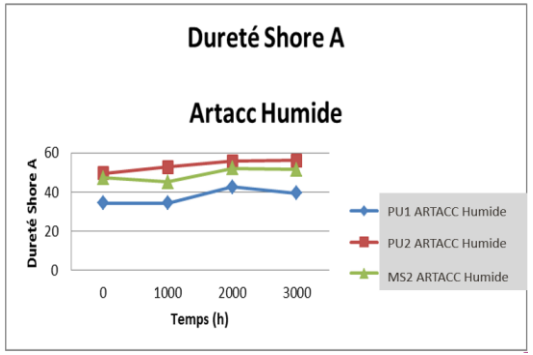
MS sealant : MS2

VALIDATION METHOD FOR SEALANTS

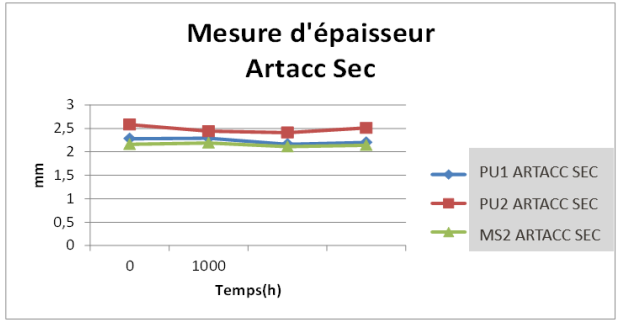
Validation tests results

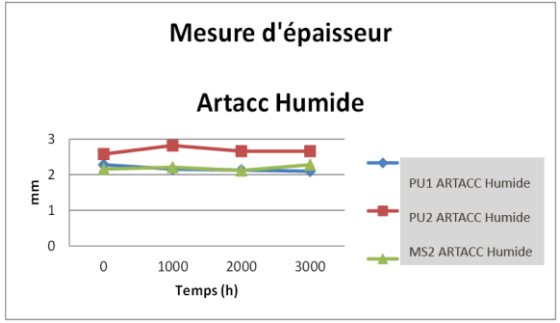
Hardness SHORE A :





Thickness :

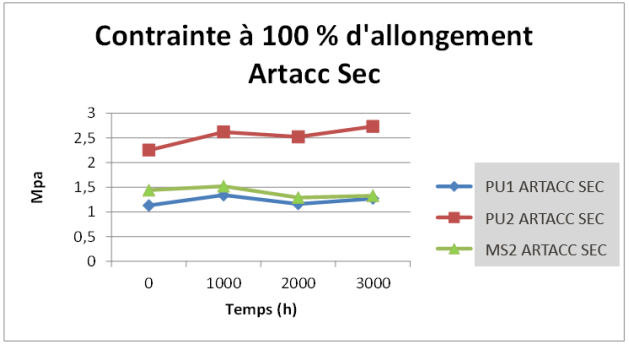


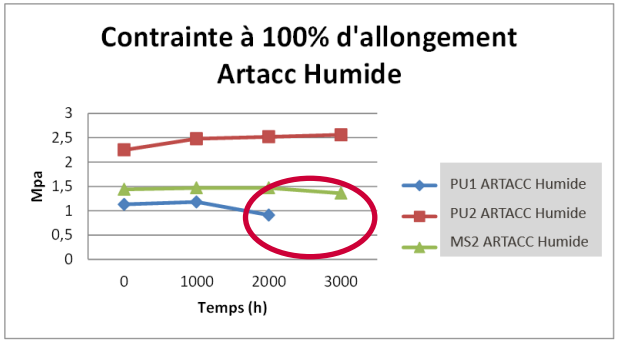


VALIDATION METHOD FOR SEALANTS

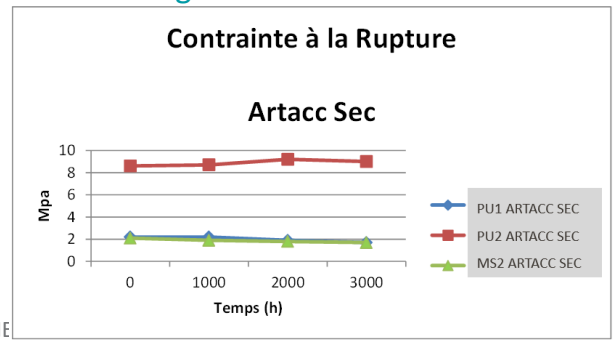
Validation tests results

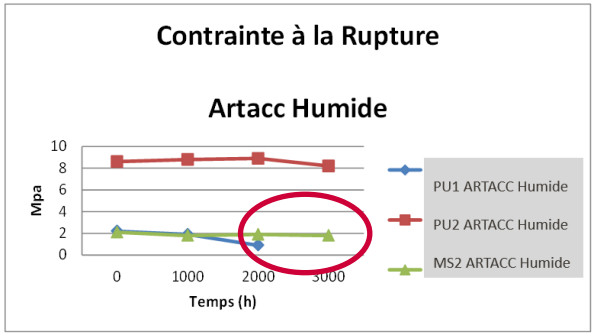
Strength value at 100% elongation :





Tensile strength:

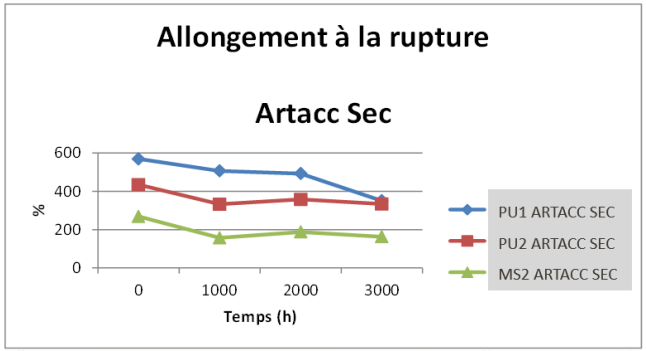


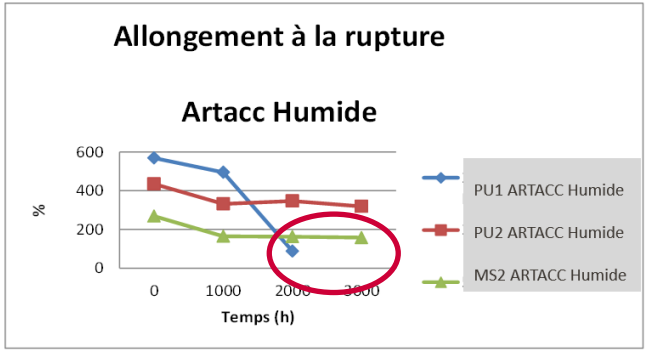


VALIDATION METHOD FOR SEALANT

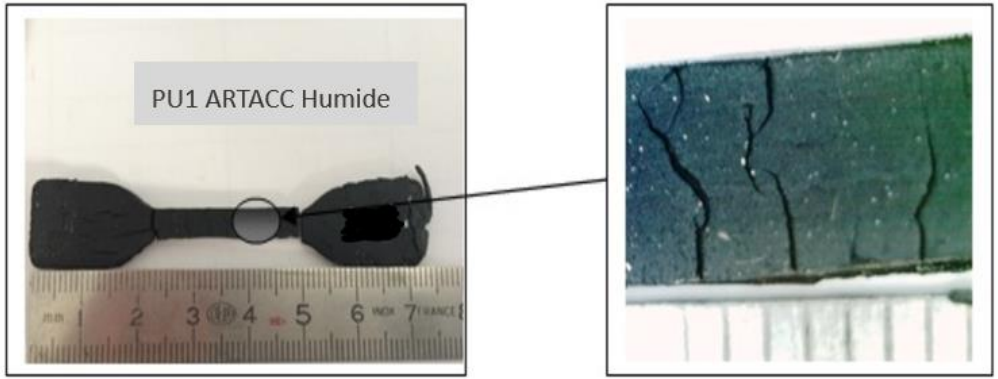
Validation tests results

Elongation at tensile strenght:





Supplier technical data sheet: « Due to its excellent weathering resistance it is well suitable for open joints. »



03. APPLICATION OF METHOD TO BAD RETURN OF EXPERIENCE

Sealant MS1 case

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« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

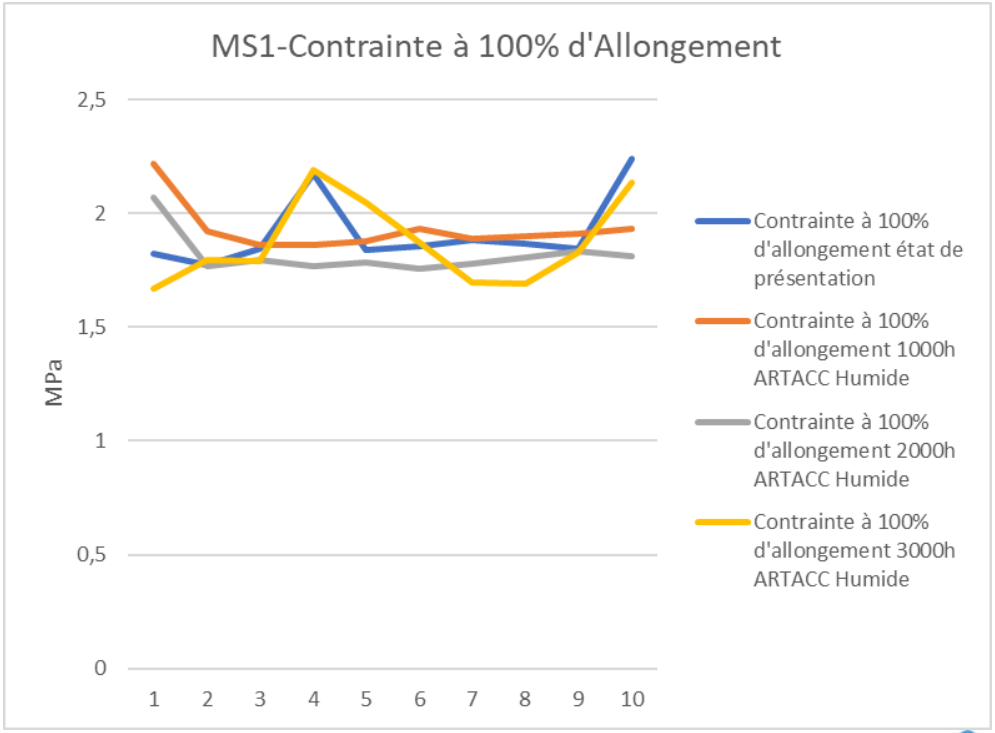
Sealant MS1

Supplier TDS : Very good UV-resistance and ageing properties !!!

« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

MS1 sealant « BANDOL WHEEL® » test results

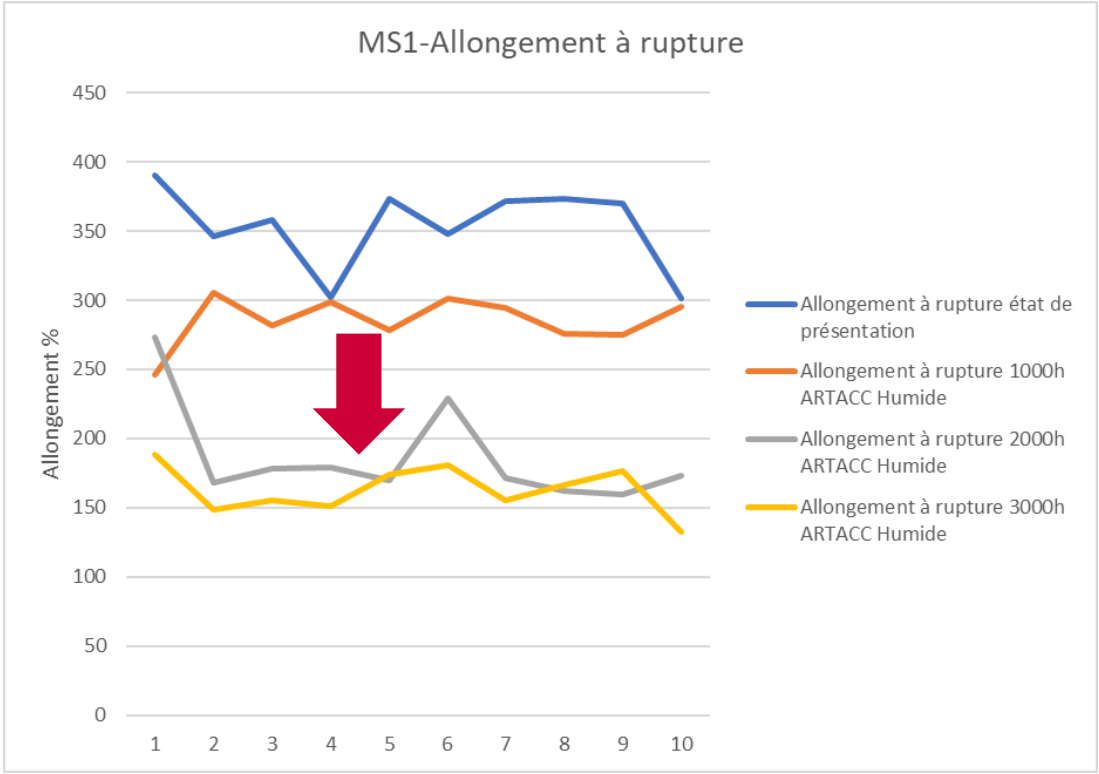
Strength value at 100% elongation :



« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

MS1 sealant « BANDOL WHEEL® » test results

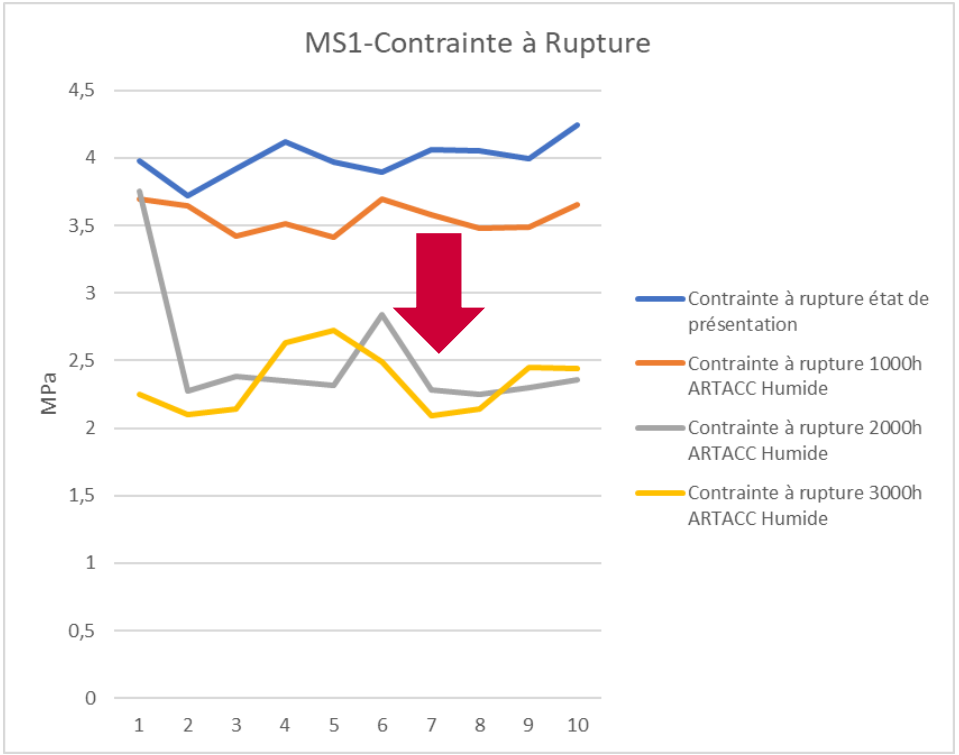
Elongation at tensile strenght :



« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

MS1 sealant « BANDOL WHEEL® » test results

Tensile strength:



« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

MS1 sealant « BANDOL WHEEL® » test results

Visual degradation:

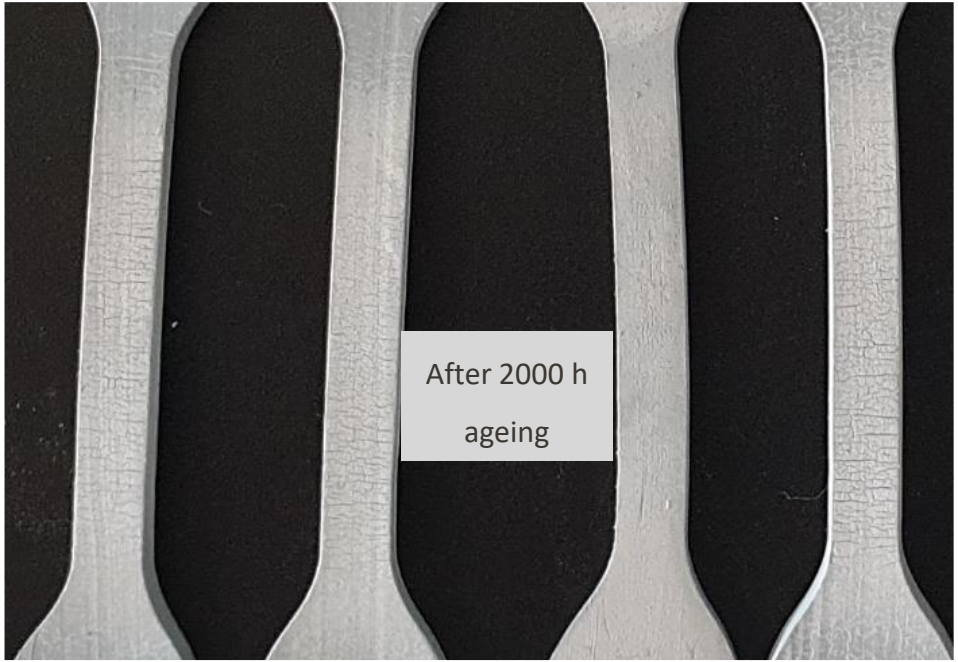
Without ageing

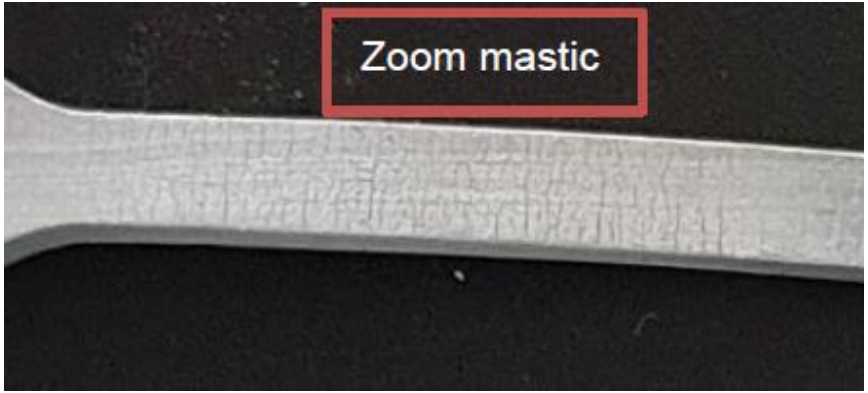
After 1000h ageing

« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

MS1 sealant « BANDOL WHEEL® » test results

Visual dégradation:

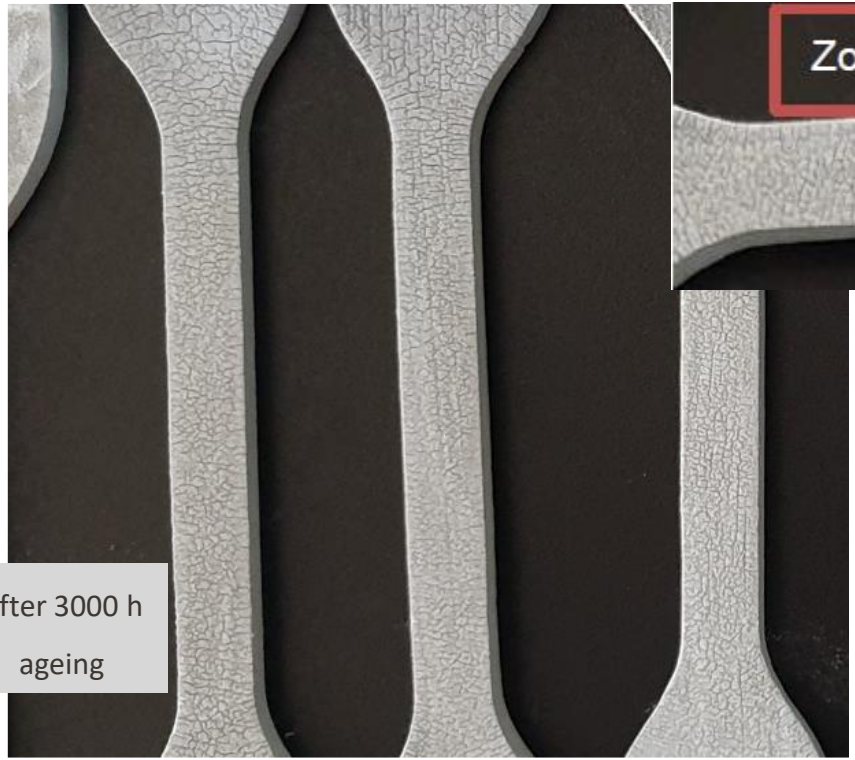




« BANDOL WHEEL® » APPLICATION FOR BAD RETURN OF EXPERIENCE

MS1 sealant « BANDOL WHEEL® » test results

Visual degradation:



After 3000 h ageing

04. APPLICATION OF METHOD FOR THE VALIDATION OF NEW BONDING APPLICATIONS

GLASS HEADLIGHT BONDING

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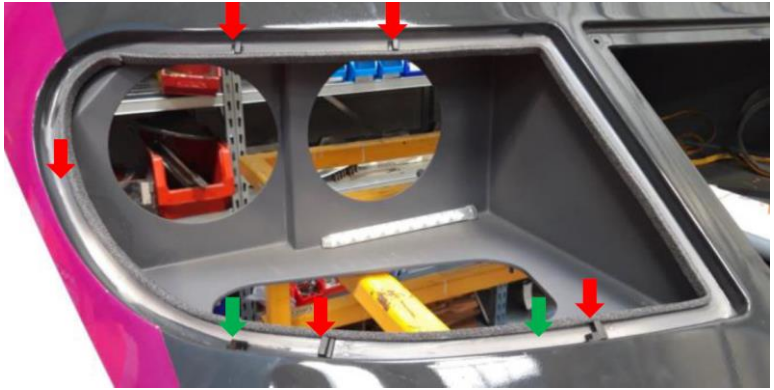
APPLICATION OF METHOD FOR THE VALIDATION OF NEW BONDING APPLICATIONS

Glass headlight bonding with MS2K1 sealant

Assembly to be made:



APPLICATION OF MÉTHOD FOR THE VALIDATION OF NEW BONDING APPLICATIONS

Glass headlight bonding with MS2K1 sealant

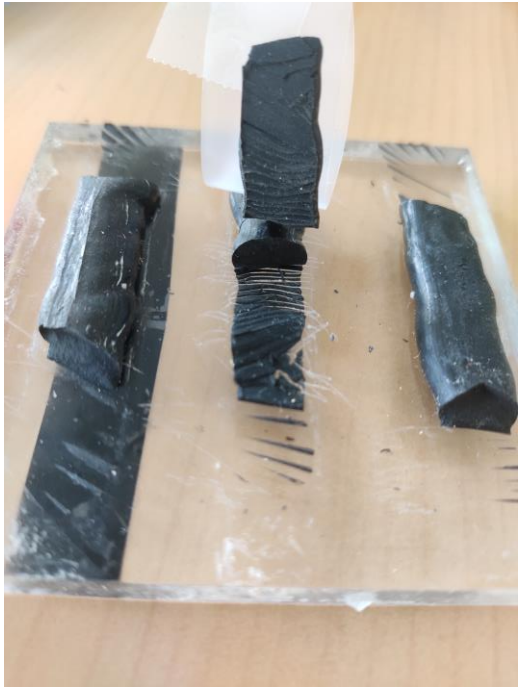
Result after Humidity « BANDOL WHEEL® » test (3000 h) for bonding joint glass/sealant :

Tests conditions:

- 3 sealants tested
- Bead Peel Tests (ISO 21194)
  - Before ageing
  - All 750 hours untill 3000 hours

Results:

- 2 OK
- 1 with a loss of adhesion after 3000 heures



APPLICATION OF MÉTHOD FOR THE VALIDATION OF NEW BONDING APPLICATIONS

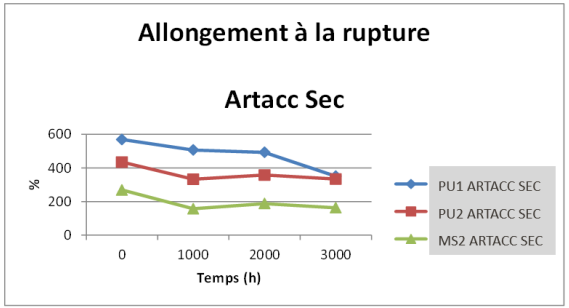
Glass headlight bonding with MS2K1 sealant

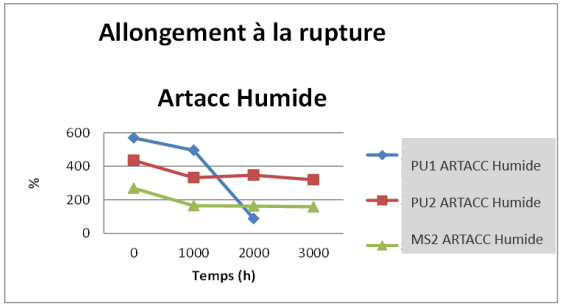
Good return of experience since July 2015 :

05. CONCLUSION

To summerise

The accelerated ageing « BANDOL WHEEL® » method, in dry mode (used for painting), doesn't reveal damage observed on train.





In contrast, the accelerated ageing **« BANDOL WHEEL® » method, in humidity mode (exposure at 50°C for 3000 hours with 30 % of time in hidden immersion)** allows to validate sealant behaviour in rollingstock conditions.

THANK YOU FOR YOUR ATTENTION

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