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TECHNICAL REPORT

"SOUND ABSORPTION BEHAVIOUR and TENSILE MODULUS BEHAVIOUR of Soundabsorber SEALED AIR material STRATOCELL WHISPER UV (63697) under ACCELERATED AGEING TESTS in QUV-Chamber."

Service requested by the company SEALED AIR

SUMMARY

This report deals with the degradation analysis of Sound absorber materials named as **Stratocell Whisper UV** (ref. 63697) provided by the company SEALED AIR. The mechanical behaviour (tensile modulus) and the sound absorption properties of these materials have been studied on samples exposed to an accelerating ageing test with a QUV chamber that combines ultraviolet exposition with a water spray atmosphere in alternative cycles.

TESTING TO DETERMINE CHANGES IN TENSILE MODULUS TEST UNDER QUV ACCELERATED EXPOSITION

The mechanical behaviour of Sealed Air sample 63697 exposed to the accelerated ageing in QUV was analysed taking measurements of the tensile modulus of samples exposed to a total of 1000, and 2000 hours QUV. A total of eight samples measurements were considered for each QUV exposure time in order to get an average value.

Tensile modulus were obtained from Thermal Dinamo-mechanical analysis (TDMA) performed with a Mettler Toledo DMA/SDTA861 equipment incorporating a dual cantilever for a configuration consisting in three points of sample fixation two in the laterals and one in the central part where the oscillatory load is applied. The frequency was 1 kHz for a 20 mm deformation range. Heating rate was adjusted to 3º/minute in order to have a temperature range from -10 ºC to 60 ºC. The test conditions specified below:

Temperature range: -10 to 60 ° C
Heating rate: 3 ° C / min
Displacement: 20 µm
Amplitude of force: 2 N
Frequency: 1kHz

To reach the beginning of the experiment temperature liquid nitrogen was used as coolant.

The measured property is the elastic modulus (E ') at 25 ° C.

Accelerated weathering exposition Tests were carried out using QUV equipment supplied by Q-Panel lab products equipped with fluorescent UV-B lamps (calibrated irradiance at 310 nm is 0.65 W/m^2/nm). This is considered a good match with noon summer sunlight. Each twelve-hour cycle comprised eight hours of UV radiation at 60℃ and four hours of condensation at 50℃. The UV exposure and condensation exposure occur separately to simulate natural weathering conditions. The testing conditions for 1 cycle are:

QUV 1 Cycle= 8 hours UVB-313 nm at 60ºC+ 4 hours water spray at 50 ºC

- Sample 63697 Before QUV aging: E '= 40,5 ± 2 MPa
- Sample 63697 After 1000 hours QUV aging: E ' = 36,5 ± 2 MPa
- Sample 63697 After 2000 hours QUV aging: E ' = 29,5 ± 2 MPa

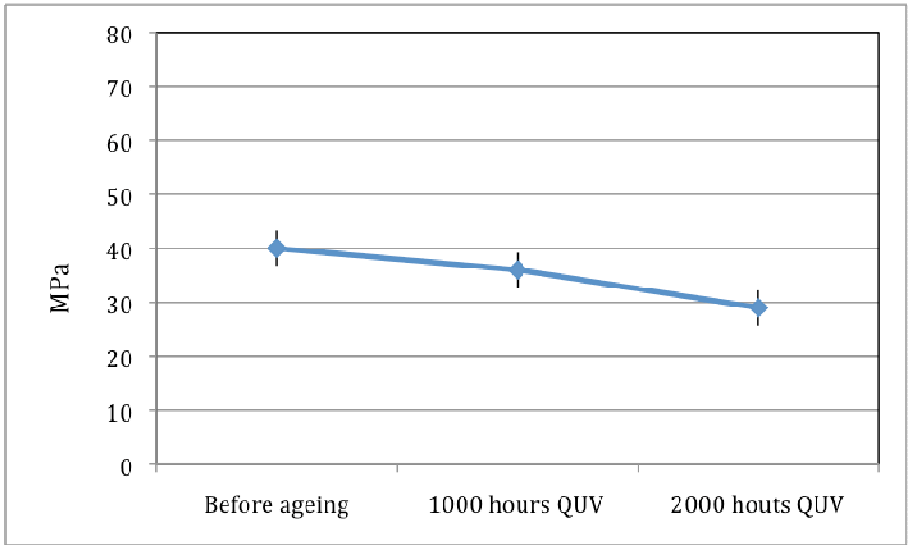

Fig1. Tensile modulus of sample 63697

Testing to determine changes on sound absorption behaviour UV-B 63697

All the samples were tested using the impendence microphone method, UNE-EN 10534-2. Three samples (m1, m2, m3) of both types, before and after the UV aging process have been tested. To carry out the test, we've cut several cylindrical samples of 4 cm of diameter.

Fig1. Cilindrical sample placed inside the pipe.

In the small scale, acoustic behavior of this kind of material is similar to a resonator. This means that the absorption graph has a sharp zones with a maximum value followed of valleys with minimum absorption zones. But when we use it in a real size using a wedge form, the absorption graph of this kind of materials becomes in a flatter line.

Following, it´s shown the graphs obtained after averaging the three measurements obtained from the both type of sample, before and after the 1000 hours of UV aging.

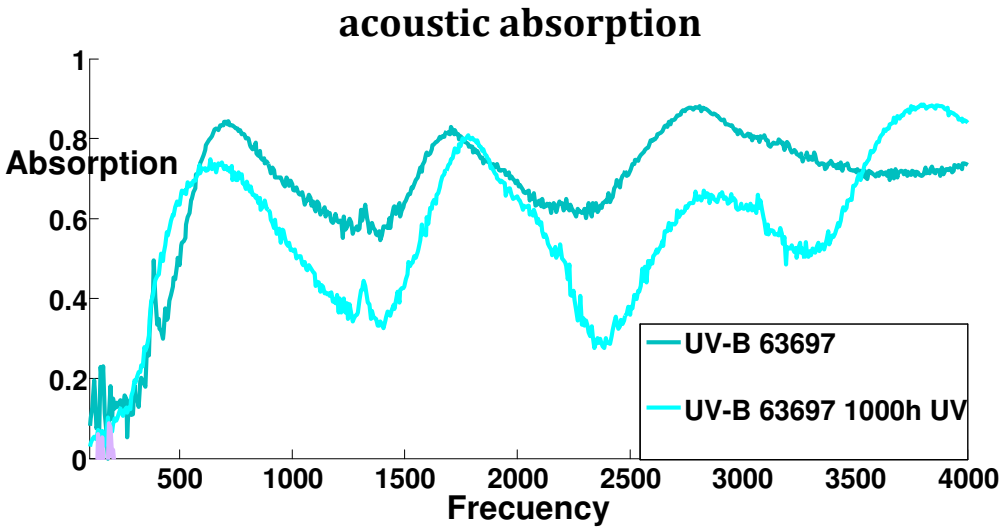

Fig 3. Result obtained for sample UV-B 63697 before and after 1000h of UV aging .

Following, it´s shown the graphs obtained after averaging the three measurements obtained from the both type of sample, before and after the 2000 hours of UV aging.

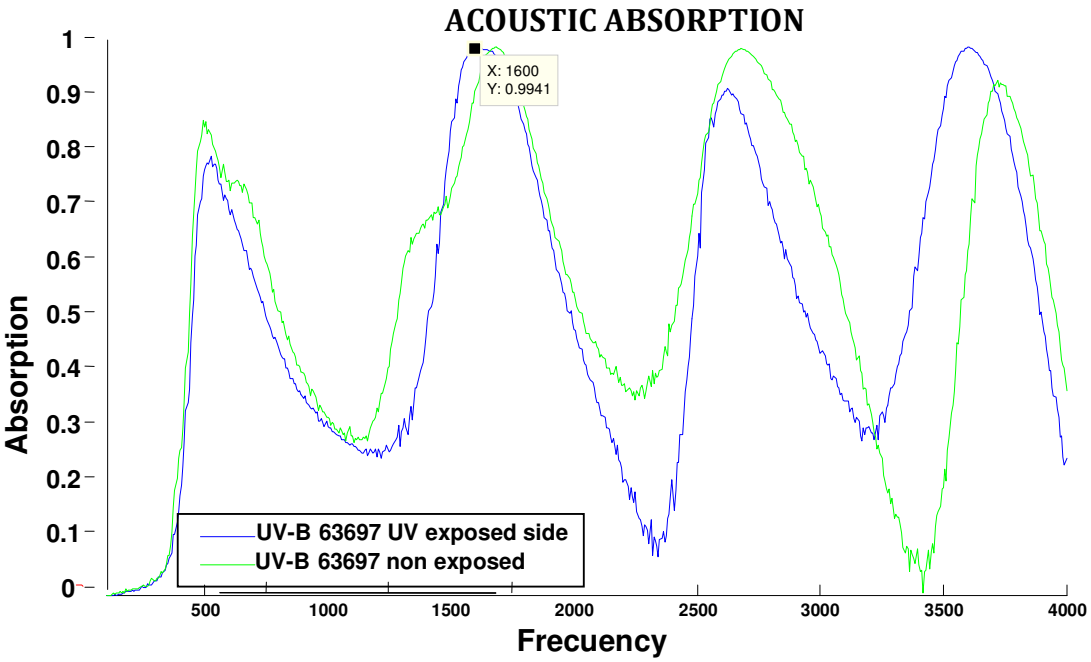

Fig 4. Result obtained for two samples S63697 in both faces, front side (UV exposed) and reverse (non exposed), after 2000h of UV aging.

Finally it´s shown the graphs obtained after 2500 hours.

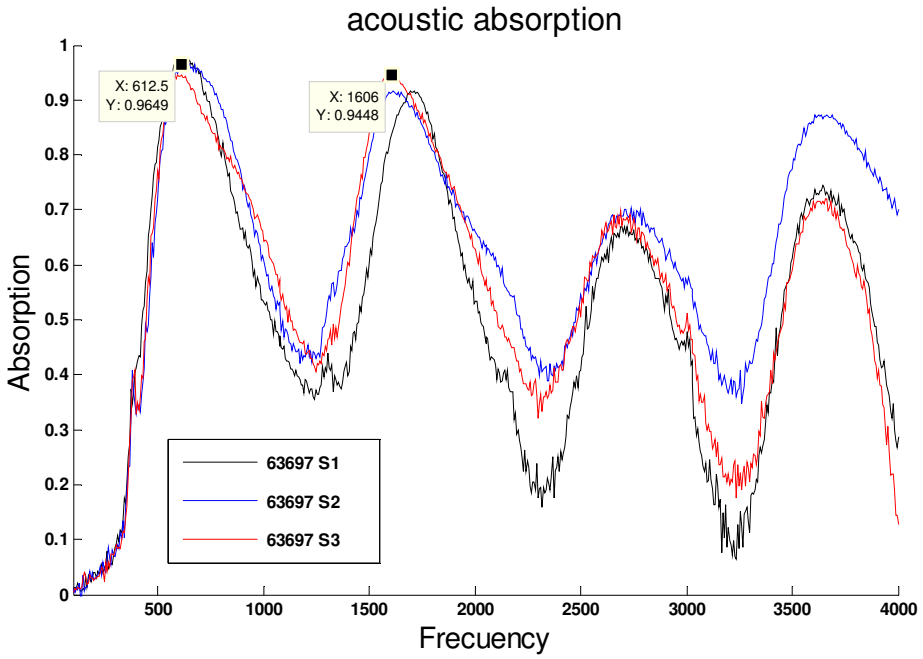

Fig 5. Result obtained for three samples UV-B 63697 after 2500 aging hours.

Conclusions

1. **The modulus of after 2000 hours QUV ageing decreased from 40 to 29 MPa. It is normal to consider that a material is good if the modulus is > 50% of the original. And 2000 hour in the QV chamber is considerate to be equal to >20years outside exposure in Spain sunny environment.**
2. **The material after 1000, 2000 and 2500 hours exposed to UV accelerating process shows an acoustic behaviour similar to the samples not aged.**

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