

HA Safeoam NF : longevity of cured material

Introduction

This report describes tests to estimate the longevity of cured HA Safeoam NF; the principle is to expose cured HA Safeoam NF to high temperatures (80°C and 45 °C) and to monitor the decrease in tensile strength under both storage conditions. In this experiments the critical level of the tensile strength is 70 % of the original value. If the decrease in both conditions is different, the results can be put in an Arrhenius plot. With this equation it will be possible to extrapolate the time needed to decrease the tensile strength to 70 % of the starting value at e.g. 20°C.

Method

HA Safeoam NF is poured on HDPE plates of 30 cm x 30 cm in order to avoid adhesion and to obtain free films of cured material. The layer thickness is approx. 2 mm. The plates are stored in ambient conditions during 7 days.

After 7 days profiles are made according ISO 527.

All the samples are stored in tap water during 7 days at ambient temperature (20 – 23 °C). Then the tensile strength according ISO 527, rate 50 mm/min, is measured on 3 samples of cured HA Safeoam NF; this is the starting value. The other samples are divided in 2 groups; 1 group of samples is stored in tap water at 45°C, the other group is stored in tap water at 80°C. The recipients are not completely closed to avoid pressure built-up and at regular time intervals water is added to the recipients so that the samples are completely immersed at all times.

At regular time intervals the tensile strength is measured on samples stored at 45°C and at 80°C; each value in this report is the average of 3 individual measurements.

The test started on 22/07/2011 and ended on 04/09/2013.

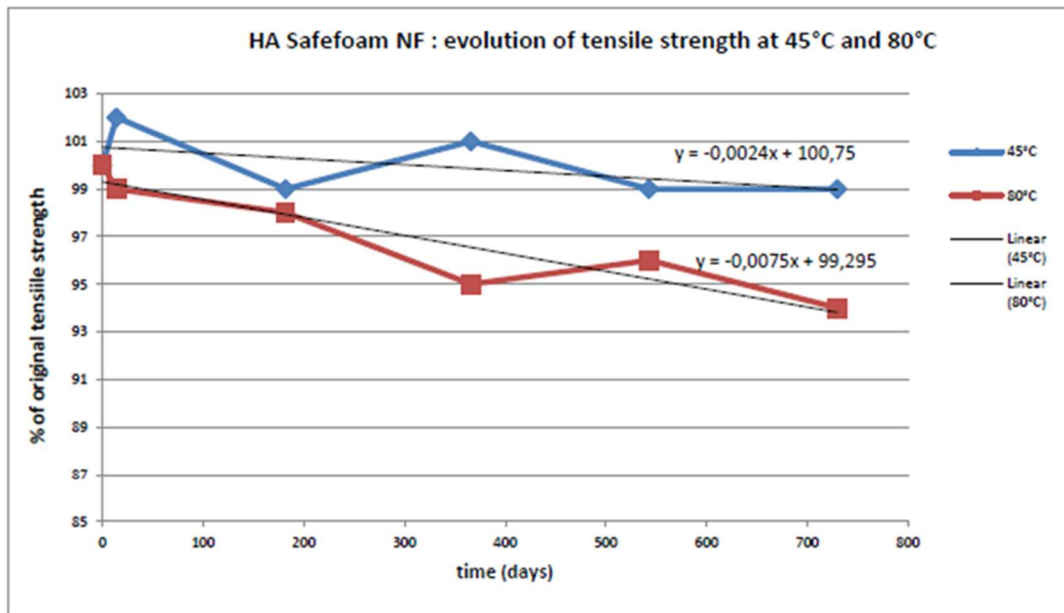
Results

The following table shows the results of the tensile measurements. The results are expressed as % of the starting value; the starting tensile strength was 11,03 MPa; this is the tensile strength measured on 3 samples after 7 days air curing and 7 days storage in tap water at 20 – 23°C.

Days immersion	% of original TS 45°C	% of original TS 80°C
0	100	100
14	102	99
182	99	98
366	101	95
543	99	96
730	99	94

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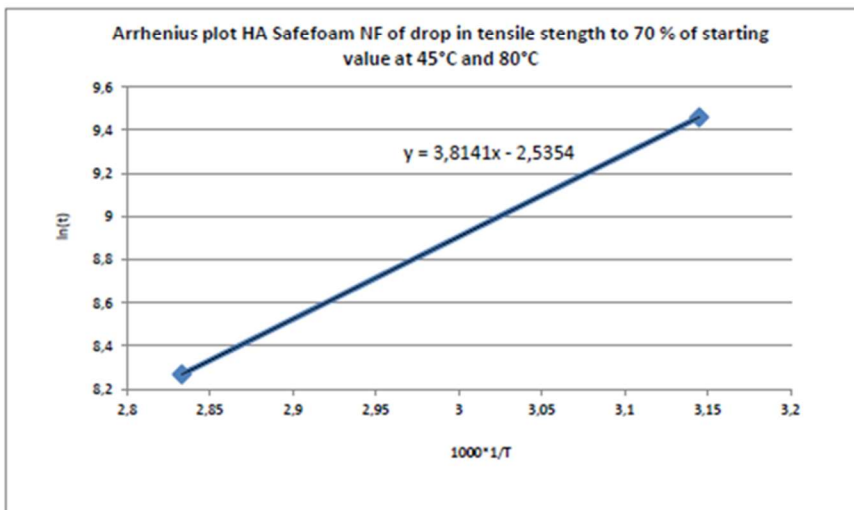


With the equations of both trend lines the time for the tensile strength to drop to 70 % of the starting value can be calculated :

At 45°C it will take 12812 days for the tensile strength to drop to 30 % of the starting value.

At 80°C it will take 3906 days for the tensile strength to drop to 30 % of the starting value.

An Arrhenius plot can be made by putting the temperatures in $1/K * 1000$ and taking the logarithm of the time in days. The Arrhenius plot for the decrease of the tensile strength of HA Safefoam NF is given in the following graph :



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In this way it can be calculated how long it would take at 20°C for the tensile strength of HA Safeoam NF to drop to 70 % of the starting value :

20 °C = 293 K, and $1000 \cdot 1/T = 1000 \cdot 1/293 = 3,413$. Replacing x in the equation by 3,413 gives $y = 10,482$ or $\ln(t) = 10,482$. Therefore $t = e^{10,482} = 35667$ days, or 97,7 years.

Conclusion

In order to try to assess the life expectancy of cured HA Safeoam NF a product property has to be monitored and a critical value is to be chosen; in the reported experiments the monitored property is the tensile strength and the critical value is set at 70 % of the starting tensile strength.

This report describes measurements of the tensile strength of cured HA Safeoam NF samples stored in water at 45°C and 80°C. The evolution of the tensile strength was monitored during 2 years. Out off the difference of the evolution of the tensile strength of samples stored at 45°C and 80°C an Arrhenius plot can be made; this plot enables to extrapolate the time required for the tensile strength to drop until 70 % of the starting value at ambient temperatures. The outcome of the tests in this report is that it takes almost 98 years for the tensile strength of HA Safeoam NF to decrease until 70 % of the starting value stored in water at 20°C.



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