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HA Cut AF : longevity of cured material

Introduction

This report describes tests to estimate the longevity of cured HA Cut AF; the principle is to expose cured HA Cut AF to higher temperatures (80°C and 50 °C) and to monitor the decrease in compressive strength under both storage conditions until a critical level is reached. In this experiments the critical level of the compressive strength is 80 % 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 80 % of the starting value at e.g. 20°C.

Method

HA Cut AF is cured in confined conditions in a stainless steel mold. The cured product is cut in blocks of 4 cm x 4 cm x 4 cm. In total 60 blocks were made. The blocks are stored in sand 0,2–0,4 mm; half of the samples is stored in a closed recipient at 50 °C and the other half is stored at 80 °C. At regular time intervals 4 samples of each test condition are tested on compressive strength. This monitoring is done until a decrease of the compressive strength of 20 % in one or both conditions can be observed. The difference in the rate of decrease in both conditions allows to put the data in an Arrhenius plot. With the Arrhenius plot an extrapolation can be made of the time needed to reach a decrease of 20 % in compressive strength at normal conditions, eg. 20°C.

The test started on 07/09/2016 and ended on 07/12/2017.

Results

The following graph shows the results of the compressive strength measurements. The results are expressed as % of the starting value; the starting compressive strength was 55 MPa. Each data point is the average of 4 individual measurements.

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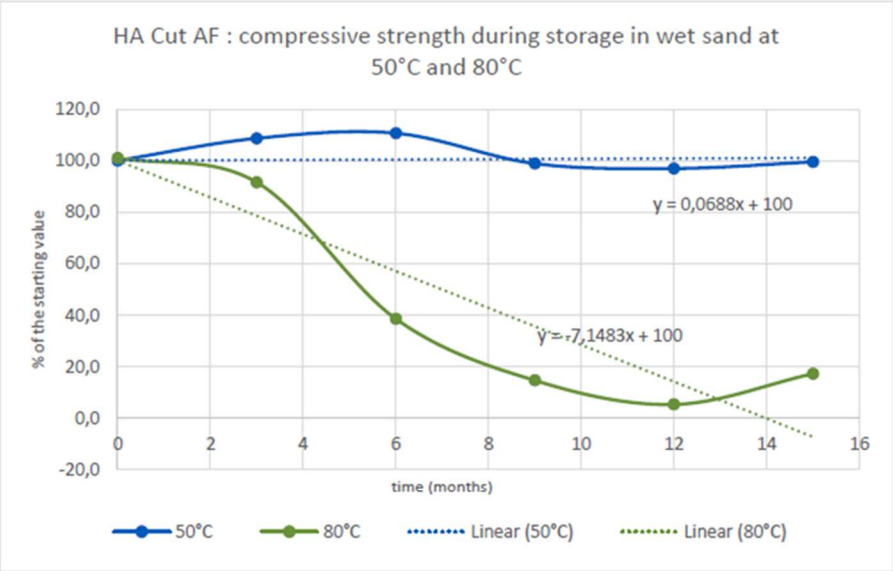
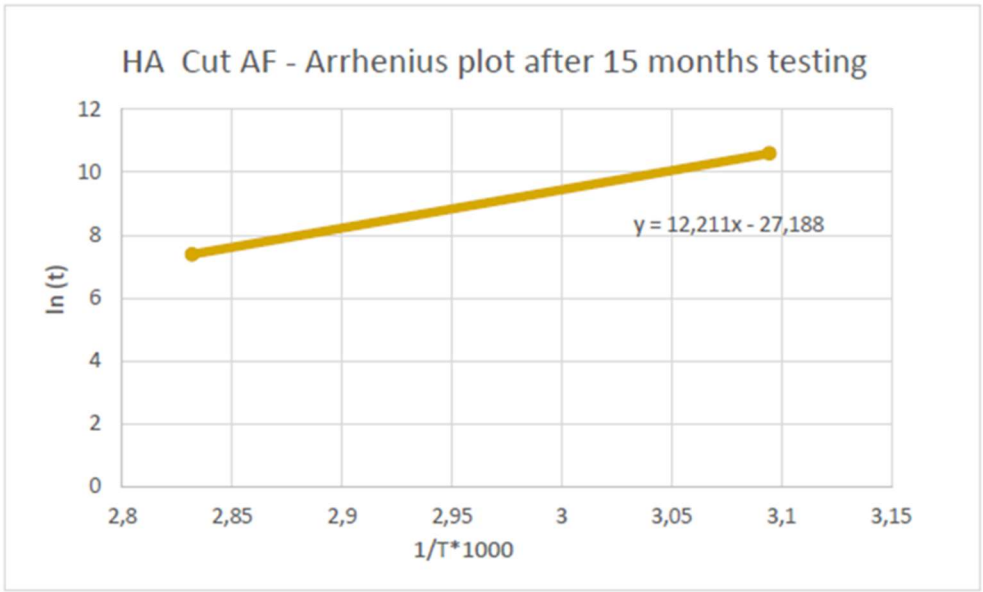


With the equations of both trend lines the time for the compressive strength to drop to 80 % of the starting value can be calculated. The following Arrhenius plot can be made by putting the temperatures in 1/K * 1000 and taking the logarithm of the time in hours.



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In this way it can be calculated how long it would take at 20°C for the compressive strength of HA Cut AF to drop to 80 % of the starting value : the result of this calculation is more than 120 years.

Conclusion

In order to try to assess the life expectancy of cured HA Cut AF, a product property has to be monitored and a critical value is to be chosen; in the reported experiments the monitored property is the compressive strength of HA Cut AF samples stored in wet sand at 50°C and 80°C, and the criticial value is set at 80 % of the starting compressive strength.

The evolution of the compressive strength was monitored during 15 months. Out off the difference of the evolution of the compressive strength of samples stored at 50°C and 80°C an Arrhenius plot can be made; this plot enables to extrapolate the time required for the compressive strength to drop until 80 % of the starting value at ambient temperatures. The outcome of the tests in this report is that it takes at least 120 years for the compressive strength of HA Cut AF to drop to 80 % of the original value when in contact with wet sand at 20°C.

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