# AGEING MODULE – MASTER CURVE

*Recommended for cases with fatigue life longer than $10^6$ cycles, and when ageing must be taken into account.*

**Note: It is required to run FPM-IS in order to run this Module.**

The extended life module is recommended when the material operates below the endurance limit. Although cracks may not grow due to mechanical fatigue, the material properties may still evolve with exposure to heat history. A series of oven ageing experiments is used to develop master curves showing the evolution of stiffness, intrinsic strength, and fracture strength with time. The protocol also produces an estimate of the activation energy of the Arrhenius rate law describing the time-temperature dependence of ageing in the material.

## Experiment Overview

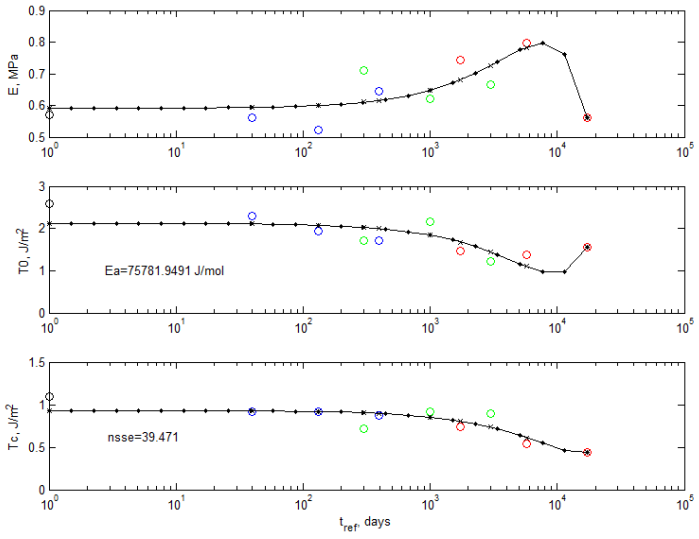
- ageing in oven at 3 temperatures for 3 time periods: 3 days, 10 days, 30 days
- static tearing raw data, 3 ageing periods x 3 ageing temperatures
- cutting force raw data, 3 strain levels x 3 ageing periods x 3 ageing temperatures
- number of slabs needed for test: 30

## Analysis and Reporting / Deliverables

- cutting vs. tearing curve at each aged condition
- intrinsic strength $T_0$ vs. ageing master curve
- tearing energy $T_c$ vs. ageing master curve
- Arrhenius activation energy, $E_a$
- fatigue threshold strain, stress, energy vs. ageing curves (when ordered with FPM-C)
- parameters specifying ageing time and temperature dependence of $T_0$ and $T_c$
- extrapolation of ageing effects to longer timescales for an application-specific temperature

**Use with**

- Arrhenius ageing law




23 C
50 C
75 C
100 C

Ageing experiments over a 3x3 matrix of oven temperature and time settings are used to develop accelerated degradation curves. Based on the Arrhenius rate law, the accelerated degradation curves are compiled into a master curve for a specific reference temperature (here, the reference temperature is 23° C).

**FPM-AM Ageing Module – Master Curve $14,850**