4. Results and Discussion

Conversion / %	E_a / kJ/mole	A / min^{-1}	$k_{200°C}$ / min^{-1}	$k_{20°C}$ / min^{-1}
90	160	$4.68 * 10^{12}$	$10.0 * 10^{-6}$	$140.3 * 10^{-18}$
85	170	$5.65 * 10^{13}$	$9.6 * 10^{-6}$	$28.1 * 10^{-18}$
80	173	$7.60 * 10^{13}$	$6.0 * 10^{-6}$	$11.0 * 10^{-18}$
75	173	$9.84 * 10^{13}$	$7.7 * 10^{-6}$	$14.0 * 10^{-18}$
70	175	$1.21 * 10^{14}$	$5.7 * 10^{-6}$	$7.6 * 10^{-18}$
60	180	$1.68 * 10^{14}$	$2.1 * 10^{-6}$	$1.3 * 10^{-18}$
Mean value	**172**	**$8.60 * 10^{13}$**	$8.6 * 10^{-6}$	$18.6 * 10^{-18}$
Literature[2]	179	**$4.20 * 10^{14}$**	$6.3 * 10^{-6}$	$4.2 * 10^{-18}$

Table 1: Activation energy, frequency factor and rate constants

Table 1 gives an overview of activation energies and frequency factors having been evaluated at different conversion rates. Frequency factors of first order decomposition mechanism, as assumed by ASTM E 1641, are generally in a range of 10^{15}-10^{12} min^{-1}. The mean frequency factor A of $8.6*10^{13}$ and the A of $4.2*10^{14}$ evaluated by Dubova et al.[2] are in compliance with the theory. The activation energy E_a >150kJ/mole indicates a thermal stable chemical compound. It has to be mentioned for a better understanding that the error of E_a and A are not independent and the comparison of those values is difficult, especially if we compare the results at different conversion rates. Therefore following the Arrhenius theory the decomposition rate constants at 200 °C and 20 °C were calculated. The rate constants at 200 °C are in the same order of magnitude an differ maximum by a factor of 5, which is fairly well. Mean value and literature value just differ by 30 % which is a perfect error range for rate constants. The results presented here confirm the EVA activation energy and frequency factor known from the literature. As the decomposition rate constant found with the MASTERSEAL® 345 EVA is higher, the following considerations are based on the results of this study.
The calculation of k at 20 °C gives $18.6 * 10^{-18}$ min^{-1}. This is a very small value and indicates the stability of EVA.
The half life of a compound is calculated by:

$$t_{1/2} = \frac{\ln 2}{k}$$

The half life $t_{1/2}$ of EVA is $71*10^{9}$ years, this is twenty times more stable than the ^{238}Uranium isotope. Or to have a more descriptive picture of the MASTERSEAL® 345 thermal endurance: To get a decomposition of 1mg out of 1 ton material we would have to wait 102 years. This is not measurable in a reasonable timescale, but explains the previous mentioned results of Schulze and Killermann[3] who exposed the EVA modified mortars over a period of ten years to different indoor and outdoor conditions neither finding a change in the morphology of the polymer nor observing changes in adhesive, flexural or compressive strength of the mortars.