Work stages: Activity 1
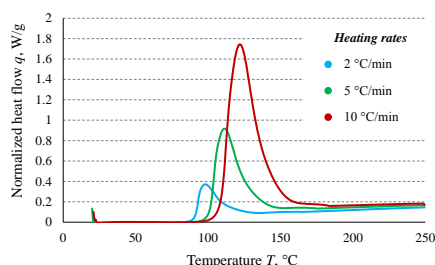
Milestone: 1

Milestone name: Curing kinetic models for the selected resins

Three types of resins widely used in Latvia for pultrusion profiles have been chosen:
- polyester resin C-L ISO 112G,
- epoxy resin RESOLTECH 1401+1407+AC140,
- vinyl ester resin CRYSTIC VE 676-03.

To define their curing kinetic parameters, 9 DSC scans have been executed by Mettler Toledo on samples heated from 20°C to 250°C at rates of 2, 5, 10 °C/min. Using these experimental results, different curing kinetic models for the selected resins have been built and their accuracy have been estimated.
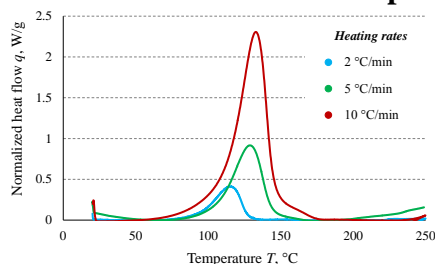
Dependence of the normalised heat flow on temperature	Parameters of curing kinetic models

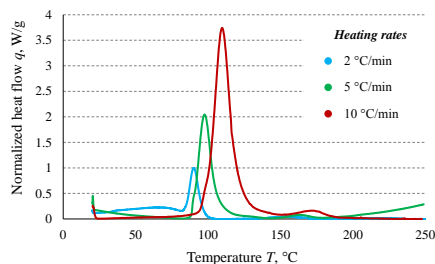### Polyester resin C-L ISO 112G

Model	Parameters						σ_r,
	n	m	K_1, s^{-1}	E_1, J/mol	K_2, s^{-1}	E_2, J/mol	%
First order	-	-	-	-	-	-	11.1
n-th order	1.88	-	-	-	-	-	9.1
n-th order with autocatalysis	1.88	-	-	-	0	-	9.1
Prout-Tompkins	0.39	1.08	-	-	-	-	3.5
Kamal-Sourour	1.27	0.0011	$2.6 \cdot 10^{13}$	116769	$1.2 \cdot 10^{12}$	200000	3.9

Epoxy resin RESOLTECH 1401+1407+AC140

Model	Parameters						σ_r,
	n	m	K_1, s^{-1}	E_1, J/mol	K_2, s^{-1}	E_2, J/mol	%
First order	-	-	-	-	-	-	2.1
n-th order	0.96	-	-	-	-	-	2.1
n-th order with autocatalysis	0.98	-	-	-	0.03	-	2.1
Prout-Tompkins	0.87	0.05	-	-	-	-	2.0
Kamal-Sourour	0.79	0.001	$3.03 \cdot 10^{11}$	104845	12000	2000000	2.1

Vinyl ester resin CRYSTIC VE 676-03

Model	Parameters						σ_r,
	n	m	K_1, s^{-1}	E_1, J/mol	K_2, s^{-1}	E_2, J/mol	%
First order	-	-	-	-	-	-	9.6
n-th order	1.23	-	-	-	-	-	9.5
n-th order with autocatalysis	1.23	-	-	-	0	-	9.5
Prout-Tompkins	0.10	0.41	-	-	-	-	3.8
Kamal-Sourour	1.63	1.01	$2.98 \cdot 10^{11}$	110865	$6.10 \cdot 10^{11}$	93241	2.2