Work stages: Activity 3

Milestone: 9

Milestone name: Curing kinetic models for the selected protective coatings

Three types of protective coatings have been chosen for pultruded profiles:

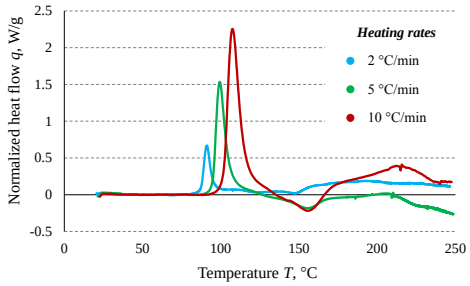
- polyester Crystic Firequards,
- epoxy Resoltech Resolcoat 2010 FGCS,
- vinyl ester VE gelcoat.

To define their curing kinetic parameters, results of DSC scans performed by Mettler Toledo on samples heated from 20°C to 250°C at rates of 2, 5, 10 °C/min have been utilised. Using these experimental results, different curing kinetic models for the selected protective coatings have been built and their accuracy have been estimated.

Dependence of the normalised heat flow on temperature

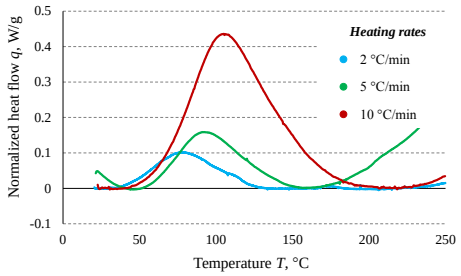
Parameters of curing kinetic models

Polyester Crystic Firequards



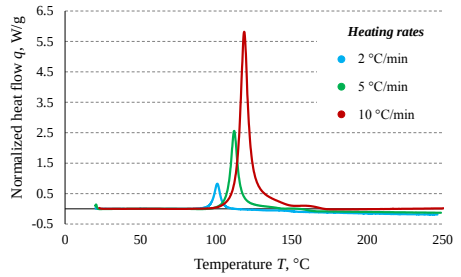
Model	Parameters						σ_r, %
	n	m	K_1, s^{-1}	E_1, J/mol	K_2, s^{-1}	E_2, J/mol	
First order	-	-	-	-	-	-	9.7
n-th order	1.88	-	-	-	-	-	8.1
n-th order with autocatalysis	1.88	-	-	-	0	-	8.1
Prout-Tompkins	0.96	0.39	-	-	-	-	4.2
Kamal-Sourour	1.23	0.0011	$1.56 \cdot 10^{20}$	159800	12000	200000	4.7

Epoxy Resoltech Resolcoat 2010 FGCS



Model	Parameters						σ_r, %
	n	m	K_1, s^{-1}	E_1, J/mol	K_2, s^{-1}	E_2, J/mol	
First order	-	-	-	-	-	-	7.6
n-th order	1.87	-	-	-	-	-	3.8
n-th order with autocatalysis	1.87	-	-	-	0	-	3.8
Prout-Tompkins	1.65	0.19	-	-	-	-	1.8
Kamal-Sourour	1.24	0.40	240562	55843	10100	114445	2.0

Vinyl ester VE gelcoat



Model	Parameters						σ_r, %
	n	m	K_1, s^{-1}	E_1, J/mol	K_2, s^{-1}	E_2, J/mol	
First order	-	-	-	-	-	-	8.8
n-th order	1.79	-	-	-	-	-	7.5
n-th order with autocatalysis	1.79	-	-	-	0	-	7.5
Prout-Tompkins	0.85	0.35	-	-	-	-	4.6
Kamal-Sourour	1.30	0.0011	$3.75 \cdot 10^{17}$	145155	12000	2000000	5.3

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