THERMOGRAVIMETRIC ANALYSIS OF WASTE CAR TIRES

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A huge amount of car tires is produced in the world, and after the end of their useful life, they are thrown into landfills. Nowadays, in the world, 9.5 million tons of car waste per year harms the environment – 1.7 million tons in France, 1.9 million tons in Russia and 2.2 million tons in the USA. Especially in large industrial enterprises, including mining and metallurgical enterprises, a large amount of car tires of heavy-duty vehicles are polluting the environment by being dumped in landfills. In one year, the amount of tires used in the Navoi Mining and Metallurgical Combine is about more than 900 thousand tons. This leads to an increase in the amount of waste produced and, in turn, to the destruction of ecology. Therefore, the effective use of this kind of waste is one of the urgent issue.

The analysis of the scientific literature shows that [1-3] the most optimal ways to obtain a useful product by recycling rubber products is the thermal pyrolysis method. One of the important methods of researching thermal changes in resin products is thethermogravimetric methods.

This work presents the results of thermogravimetric analysis of rubber technical materials in the temperature range of 20-890 ^{0}C. Thermogravimetric analysis of rubber materials are performed by using a derivatograph Labsys™ Evo, developed to ensure ease of use and to obtain reliable and high performance indicators. The device is adapted for appliance in laboratories conducting research and quality control. Devices of the series Labsys™ Evo have a structure including: i) thermogravimetric balance (TG) connected to converters DTA and DSC; ii) metal-resistor furnace; iii) has multi-tasking software, managing various modules [4,5,6].

The 1st decomposing interval corresponds to the temperature renge of 70-310 ^{0}C, and the 2nd decomposing interval corresponds to the temperature range of 320-870 ^{0}C.

As it can be seen form Fig. 1 that intensive decay occurs in the second interval. In this interval, the main bulk of the decay takes place, i.e. 35 %. A detailed analysis of dynamic thermogravimetric analysis curve and DSC curve is given in the table 1 below.

The results of the analysis show that after the temperature increase above 780 ^{0}C, the mass loss is 38.9 % and remains unchanged, that is, the sample remains mainly metal cord residues.

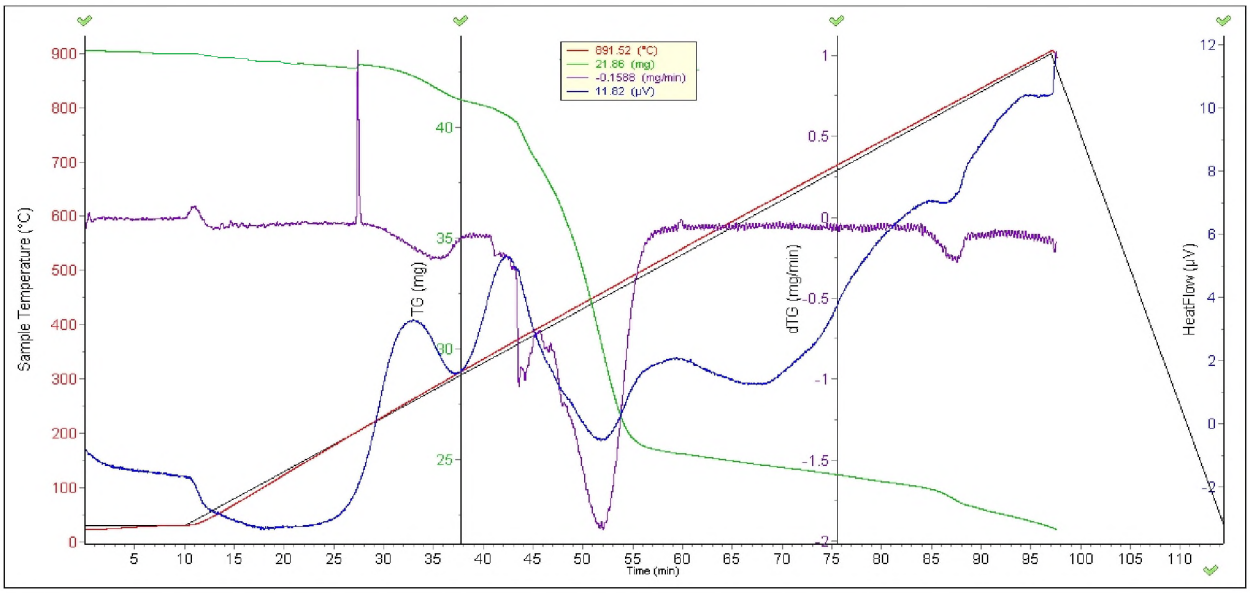

Fig. 1 Thermogram of rubber material

According the results of the table, the pyrolysis process begins above 100 ^{0}C. For example, at 400 ^{0}C, it is observed that the mass of the resin material is reduced by 5.7 mg. It will take 2400 seconds and 5.01(mV*s/mg) of energy.

Table 1

Analysis of DTA and DSCcurves of thermal decomposition of rubber materials

№	Temperature (^{o}C)	Lost mass (mg)	Lost mass (%)	Amount of used energy (μV*s/mg)
1	50	58	0	0
2	100	57.105	1.6	6.91
3	200	56.035	2,7	3.89
4	300	55.226	5.0	3.99
5	400	54.714	5.7	4.13
6	500	53.809	7.2	4.97
7	600	52.929	9.1	6.70
8	700	52.112	11.5	4.32
9	800	51.129	14.5	5.32
10	820	50.132	20.1	5.36
11	850	48.135	28.2	3.35
12	900	47.936	29.3	4.36
13	1000	46.935	32.8	3.98
14	1050	46.536	35.6	5.36
15	1100	46.123	38.9	4.36

Thus, it was determined that the optimal temperature for pyrolysis is 500-550 ^{0}C. Various organic and inorganic products are formed in different temperature ranges. Pyrolysis products are studied by chromatomasspectromericaly.

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