Thermochimica Acta, 93 (1985) 33-35
Elsevier Science Publishers B.V.. Amsterdam

THE THERMAL DECOMPOSITION OF PHENIDONE

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ABSTRACT

Phenidone $C_9H_{10}N_2O$ has found wide application in chemical and food industry. It has been investigated by thermogravimetric method. The thermal stability of phenidone, its melting point and the kinetic parameters of the first partial process of the decomposition at different heating rates were determined.

INTRODUCTION

1-Phenyl-3-pyrazolidinone (phenidone), $C_9H_{10}N_2O$ due to its strong reduction properties is widely applied as an effective stabilizing agent to many chemical compounds [1, 2]. Many processes, in the chemical and food industry, occuring at elevated temperatures are associated with the decomposition of phenidone or decomposition of formed metal phenidonates.

Since the pyrolysis of phenidone has not been investigated, we undertook the task to determine the thermal stability of this compound.

MEASURING METHODS

The thermoanalytical curves of the thermal decomposition of phenidone recorded in the typical way in the static air atmosphere [3, 4]. Thermograms were found using a 1000/1500 Paulik-Paulik-Erdey Derivatograph (MOM-Budapest). 500 mg samples of phenidone were used. α-Al_2O_3 corundum powder was used as the reference inert substance. Other conditions were as follows: temperatura range 20-1273 K, heating rate β 20-0,6 $K.min^{-1}$, DTA sensitivity 1/1-1/5 and the recorder tape rate 1-5 mm/min.

RESULTS AND DISCUSSION

In can be seen from the thermoanalytical curves of phenidone that it is thermally stable up to 395 K. In the range of 393-398 K

Proceedings of ICTA 85, Bratislava

it melts and a distinct endothermic peak is observed on the DTA curve. When melted phenidone undergoes decomposition, which is complicated process. The TG curves indicate, that the thermal decomposition of phenidone takes place in a wide temperature interval above 400 K and is characterized by a total egzothermic effect. The decomposition of phenidone is bound with the opening of the pyrazolidinone ring and with the degradation the phenyl ring. In the presence of air these reactions are accompanied by some oxidation processes. The total mass loss observed for this decomposition exceeds 70 % and it is heating rate dependent. The kinetic parameters E_a, A and n, i.e. the activation energy, the pre-exponential factor and the apparent reaction order of the first partial process of the decomposition of phenidone were calculated by the method given in papers [3, 5]. The results are presented in Table 1.

Table 1. Kinetic parameters of the first partial process of the decomposition of phenidone computed by the least square method

Heating rate	Value of parameter		
$K.min^{-1}$	$E_a\left[kJ.mol^{-1}\right]$	$A\left[s^{-1}\right]$	n
10	67.7	6.3×10^{8}	0.7
5	66.7	1.0×10^{9}	0.8
2.5	68.6	1.6×10^{9}	1.3
1.6	78.4	2.3×10^{10}	0.4

CONCLUSIONS

1. The positions of the peaks on the DTG and DTA curves are heating reate dependent and the shift toward lower temperature when heating reate is decreased.
2. The values of the kinetic parameters indicate that when phenidone is heated in the air at very low heating rates then its oxidation occurs and a new compounds is formed.

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