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NONEQUILIBRIUM PLASMA OF PULSED DISCHARGES FOR THE PURPOSE OF AIR PURIFICATION FROM TYPICAL VENTILATION EXHAUSTS OF POLYMER PRODUCTION*

I.E. FILATOV, V.V. UVARIN, D.L. KUZNETSOV

Institute of Electrophysics, UB, RAS, Yekaterinburg, Russia
e-mail: fil@iep.uran.ru

The production of polymer materials is one of the most important sources of air polluted with volatile organic compounds (VOCs). Technologies using nonequilibrium plasma (NP) of electric discharges of various types are promising for air purification from VOC vapors [1,2].

VOCs are: monomeric compounds used to produce polymers: butadiene, styrene, acrylonitrile, methyl methacrylate (MMA), acrylic ethers and many other compounds. As a rule, these are highly toxic compounds. They can be contaminated during transportation, during the polymerization reaction, during the processing of plastics, etc. Freshly prepared plastic contains a small amount of monomer, which pollutes the air. A significant amount of VOCs is formed during the heat treatment of plastics and during their recycling in order to obtain valuable chemical raw materials.

This paper presents the results of a study of the effect of pulsed corona discharge plasma on air containing volatile pyrolysis products of polymers of wide application: Polystyrene, polymethyl-methacrylate (MMA), ABS plastic, poly-olefins and rubber. Each of the polymer materials at a temperature of 300-600°C forms a variety of volatile products, the analysis of which was carried out by the GC/MS method. These are aliphatic and aromatic unsaturated compounds of various structures, including monomers. Each of these products has a different reactivity to plasma components and different toxicity. For the research, an installation with a plasma chemical reactor, in which a pulsed corona discharge with parameters: pulse duration of 40 ns, pulse repetition rate of 10 Hz, a voltage of 100 kV, and a current of up to 100 A, described in detail in [3], was used. The method of competing reactions developed by us [4] allows us to study the relative reactivity of each of the components most effectively.

It is shown that NP removes unsaturated and saturated aliphatic compounds more effectively, and aromatic compounds are removed less efficiently. The high reactivity of unsaturated compounds is due to their reaction with ozone [5,6].

The found dependencies will be useful in the development of new energy-efficient air purification technologies for the tasks of primary and secondary plastics processing.

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