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Exothermic interaction in the nanostructured system Al_2O_3-PTFE at various heating rates MKHITAR HOBOSYAN, KAREN MARTIROSYAN, University of Texas at Brownsville — The interaction in the system Auminum oxide-polytetrafluoroethylene (PTFE, Teflon TM) is very important for the energetic systems. In this work we attempt to study PTFE-Al_2O_3 system at heating rates up to 200 °C/min. The thermodynamic analysis by using the thermochemical code HSC-7 confirmed exothermic behavior of reaction. The Differential Scanning Calorimetry (DSC) technique was used to characterize dynamic features of interaction between polytetrafluoroethylene (PTFE) and calcinated Al_2O_3 under different heating rates. The result shows that there is a transformation from endothermic to the exothermic mode. At heating rates less than 150 °C/min the reaction is mainly endothermic, while at heating rates higher than 150 °C/min we have observed an exothermic reaction behavior. In endothermic mode the activation energy was estimated to be 265 kJ/mol, and at heating rates higher than 150 °C/min the activation energy was 21 kJ/mol. The activation energy of the reaction was calculated based on the peak temperatures of heat flow curves obtained from DSC measurements, using the isoconversional method. Experimental study shows that at the exothermic mode the PTFE reacts with Al_2O_3 in a single step producing AlF_3 and carbon. The study shows that the PTFE can potentially remove the oxide layer from aluminum and increase the direct contact area between oxygen and aluminum, which increases the reaction rate and improves the energy discharge in nanoenergetic systems.

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