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Effect of Tetra-n-butyl Ammonium Hexafluorophosphate on Thermal Decomposition of Ammonium Per chlorate

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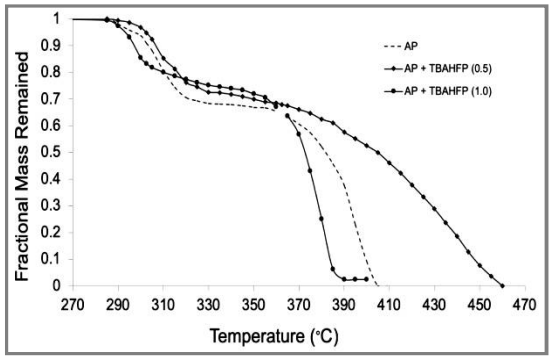
ABSTRACT

Effect of tetra-n-butyl ammonium hexafluorophosphate on the thermal decomposition of ammonium per chlorate was studied employing thermo-analytical techniques of thermogravimetry and derivative thermogravimetry in an inert atmosphere of pure nitrogen (flow rate of 30 mL min^{-1}; sample heating rate of 20°C min^{-1} and a sample mass of ~ 5.5mg. Ammonium per chlorate decomposition takes place in two stages, while that of heaxafluorophosphate takes place in a single stage. Thermal decomposition of heaxafluorophosphate mostly occurs corresponding to the second-stage decomposition of ammonium per chlorate and the same phenomena was observed when their mixtures are considered. Towards suppressing the first-exotherm of ammonium per chlorate, which is responsible for premature re-ignition of stop-restart combustion of reusable solid rocket motors, at 0.5 mass percentage of ammonium per chlorate, the presence of heaxafluorophosphate does meet the requirement. However, at higher concentration of heaxafluorophosphate, catalytic augmentation of decomposition takes place.

Graphical Abstract



TG–Curves of Pure AP, and AP with TBAHFP Mixtures.

Keywords: Ammonium per chlorate, Tetra-n-butyl ammonium hexafluorophosphate, TGA, DTG, Stop- restart rocket motors, Premature re-ignition