Prediction of NH$_4$NO$_3$ thermal decomposition parameters in the presence of two additives using the single additive experimental values

Zhe Han$^1$, Sonny Sancheva$^1$, Maria Papadaki$^2$*, and Sam Mannan$^1$*

1. Mary Kay O’Connor Process Safety Center, Artie McFerrin Department of Chemical Engineering, Texas A&M University, College Station, Texas 77843-3122, USA
2. Department of Environmental & Natural Resources Management, School of Engineering, University of Patras, SEFERI 2, AGRINIO, GR30100, GREECE

* Presenter e-mail: marpapadaki@upatras.gr

Abstract

NH$_4$NO$_3$ thermal decomposition rate is significantly affected by the presence of additives such as Na$_2$SO$_4$ (an inhibitor) or KCl (a promoter). The presence of Na$_2$SO$_4$ increases substantially the decomposition “onset” temperature of NH$_4$NO$_3$; K$_2$CO$_3$ does the same, while KCl reduces the same parameter. In this work the effect of individual additives on characteristic thermal decomposition parameters of NH$_4$NO$_3$ have been correlated and used to predict the respective parameters when two additives are present simultaneously. A simple model predicting the effect of mixtures of additives on the “onset” temperature and the temperature rise due to the thermal decomposition of AN, using the same data from the individual compounds was developed. The results showed that the behavior of each compound is independent from that of the others. The model predicts well $T_0$ and $T_f$ of such mixtures of additives.