Thermal behavior and decomposition mechanism of ammonium perchlorate in the presence of C-N conjugated polymers based on diaminomaleonitrile.

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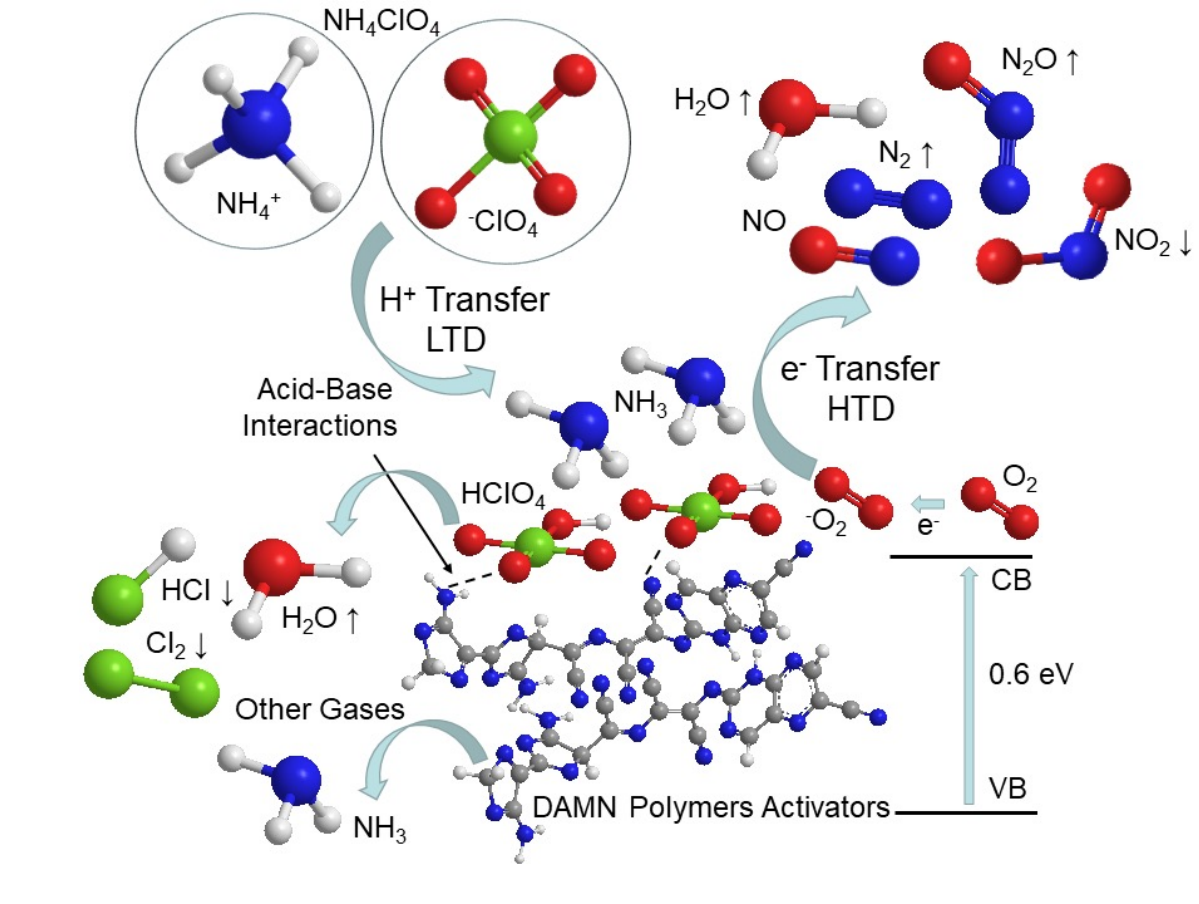

The ammonium perchlorate (AP) plays a key role in the production of highly energetic materials for application in aerospace propulsion; and the development of catalysts for the production of high burning rate (BR) propellants based on AP is an active field of research. Recently, the graphitic carbon nitrides have been used as a metal-free catalyst for the AP thermal decomposition. Following this line of C=N conjugated polymeric systems used as modifiers, herein, the thermal behavior and decomposition mechanism of AP in the presence of hydrogen cyanide (HCN)-based polymers are described. These novel functional materials can be synthesized from the HCN tetramer, diaminomaleonitrile (DAMN) by a very simple one-pot thermal bulk polymerization. In the present work, the morphological characterization of these DAMN polymeric products and their effect in the thermal decomposition of AP was performed by differential scanning calorimetry (DSC).

They were shown to exhibit catalytic activity for the thermal decomposition of this relevant oxidizer. Thus, adding 10% by mass of these nitrogen-containing conjugated polymers to AP decreases both the maximum exothermic peak temperature of decomposition and activation energy (E_a). In addition, thermogravimetry–mass spectrometry (TG-MS) analysis has allowed to evaluate the effect of these innovative activators on the AP thermal decomposition mechanism. Evolved gas analysis seems to indicate that nitrogenous species, such as N_2 and N_2O, are increased in the presence of these two-dimensional (2-D) macromolecular combustion additives. As a result, the DAMN polymers show a notable potential as a new kind of activators for the development of more efficient AP-based composite propellants.

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