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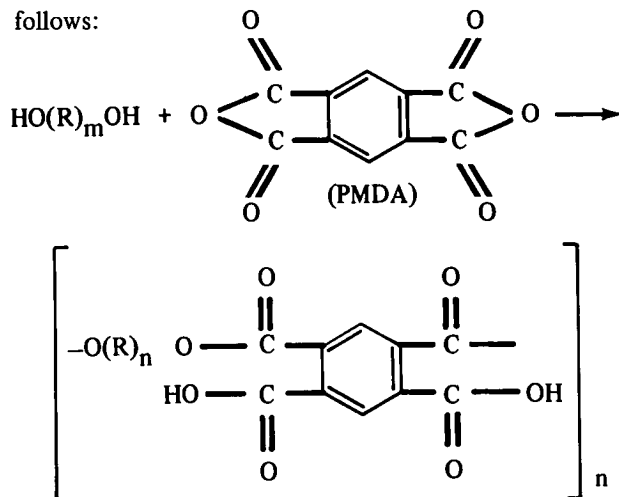
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New Polymer Systems: Chain Extension by Dianhydrides

New polymer systems are required as solid propellant binders for future long-term planetary missions and other materials applications. These binders must conform to the dimensional and mechanical properties of current propulsion systems. Moreover, the new polymers are needed to minimize volatile product evolution and radiation sensitivity in the solid propellants.

Three anhydrides were found to provide effective chain extension of hydroxy-terminated polyalkylene oxides and polybutadienes. These were tetrahydrofuran tetracarboxylic dianhydride (THFTDA), pyromellitic dianhydride (PMDA), and benzophenone tetracarboxylic dianhydride (BTDA). The most effective catalyst investigated was ferric acetylacetonate (FeAA), which resulted in chain extension at 333 K (60° C). A novel feature of these anhydride reactants is that they are difunctional as anhydrides, but they are tetrafunctional if conditions are selected that lead to total esterification or reaction of all carboxyl groups. Therefore, under appropriate conditions, chain extension can be effected and then followed by cross-linking through the residual carboxyl groups.

The chemical reaction for chain extension is as follows:



where R is a monomeric unit in the prepolymer, m is the prepolymer degree of polymerization, and n is the degree of polymerization of the extended prepolymer.

Note:

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Patent status:

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