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AEC-NASA TECH BRIEF

Polymeric Binder for Explosives

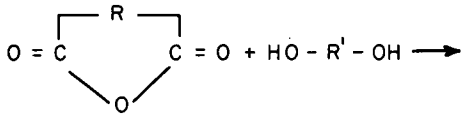
Extrusion casting of explosive charges requires a low viscosity binder capable of polymerizing to a rigid material. The low viscosity permits good mixing of the binder with the explosive and allows extrusion of the mixture into a mold.

The requirements of the finished explosive charge impose several restrictions on the polymerization reactants and reaction. The reactants must be compatible with the explosive to be fabricated. The reaction should produce a polymer of adequate mechanical strength (high molecular weight and crosslinking) and proceed at a reasonable rate at moderate temperatures (rules out exothermic polymer reactions). The reaction should not cause excessive shrinkage.

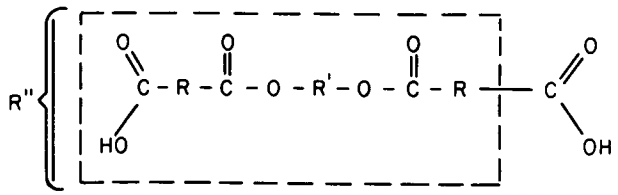
Several polymeric binders that fulfill the requirements result from the reaction of bis(fluorodinitroethyl)formal (FEFO), a glycol, a cyclic anhydride, and a polyepoxide. The FEFO is the plasticizer and source of energetic groups. The cyclic anhydride and glycol react to form a carboxyl-terminated polyester which is the polymer portion of the binder. The polymer reacts with the polyepoxide to produce chain extension and the cyclic anhydride reacts to produce crosslinking. The reaction sequence is shown in two steps.

The physical properties of the polymers produced by reaction (1) and (2) vary depending on the particular anhydride, glycol, and epoxide used. A composition of FEFO/3,4 epoxy cyclohexyl ester of 3,4 epoxy cyclohexyl methanol/maleic anhydride/diethylene glycol (70/10/7.2/3.6 parts by weight, respectively) with 0.5% by weight ferric acetylacetonate as the polymerization catalyst was found to have the best physical properties for an extrusion casting binder. A 10-gram sample of this composition was cured in an air bath at 60° C for 48 hours. The cured binder had a density of 1.487 grams per cubic centimeter.

(1)



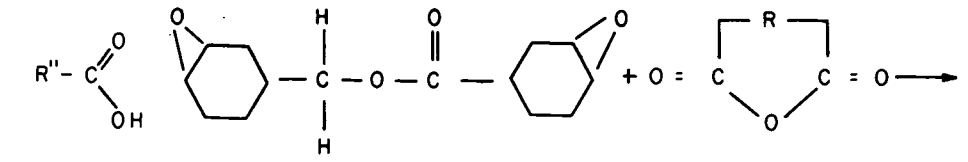
Cyclic Anhydride Glycol



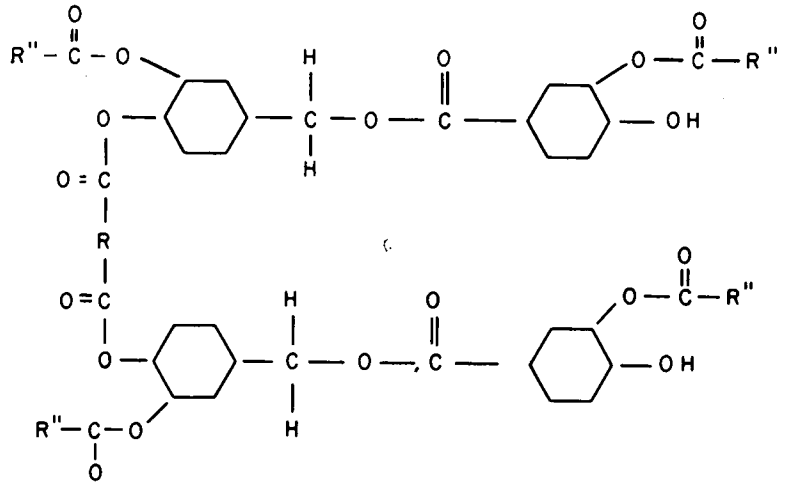
Carboxyl-Terminated Polyester

(continued overleaf)

(2)



Polyester Diepoxide Cyclic Anlydride



Crosslinked Polymer

Note:

Requests for further information may be directed to:

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Reference: TSP72-10366

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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