

ENHANCEMENT OF MATRIX/FILLER ADHESION IN AL/AP/HTPB COMPOSITE PROPELLANT

Gholam Reza Mardani

Engineering Institute Of Jahadekeshavarzi, Tehran, Iran; Email:Mardani@jercen.com

Abstract

An experimental study was conducted to understand the effect of bonding agents on the mechanical properties of ammonium perchlorate (AP) /hydroxyterminated polybutadiene (HTPB) composite propellants. Composite propellants based on hydroxyterminated polybutadiene resin are the most common contemporary solid propellant for launch vehicle and missile applications. It dominates in the propellant industry because of its superior mechanical and ballistic properties, better low temperature performance and achieving higher solids-loading. It also finds increasing use in a wide variety of application such as foams, sealants, material for electronic encapsulation and other electrical requirement. The main purpose of these measurements is to evaluate the efficiency of three bonding agents:TA-2,MAPO and MT-4 on the mechanical properties of composite propellant. TA-2 is a derivative of triethanol amine , Mapo is (2-methyl aziridinyl)phosphine oxide and finally MT-4 is chemical adduct of MAPO and adipic acid and tartaric acid. The mechanical properties of the propellant formulation from no bonding agent, TA-2, MAPO and MT-4 are presented that three bonding agent have improved mechanical properties relation to propellant formulation by no bonding agent. Tensile and elongation was increased from no bonding agent respectively. MT-4 showing the best adhesion properties between solid particles and the elastomeric binders based on HTPB.

Key words: HTPB;BONDING AGENTS; AP; MAPO

Introduction

Solid propellants based on hydroxyl terminated polybutadiene (HTPB) binders have a unique advantage in terms of high performance, good process ability, low cost and long safe use. However HTPB /AP propellants without any improve would be rather poor in the mechanical properties. A series of aziridine compounds and poly alkyl amine derivatives, being effective as the bonding agent to enhance the bond strength. Two types of HTPB prepolymers are currently used as binder in high energy solid propellants. These two types are synthesized by anionic polymerization technique(AI-HTPB), and free radical initiation process(FR-HTPB). They differ significantly in respect of both cost and properties [1]. The (AI-HTPB) prepolymer, for instance, permits the propellant to have outstanding mechanical

properties at the extremes of temperatures, which makes it ideally suited for used in tactical motors. The(FR-HTPB) prepolymer, on the other hand, is less costly and the propellant is suitable for large boosters where low temperature properties are not required to be as stringent as in the other case. The present paper concerns itself with the effect of some bonding agents on the mechanical properties of polyurethane composite propellant based on the (FR-HTPB).

Bonding mechanism

The rule of the bonding agent in improving the mechanical properties of the propellant has been reported in literature[2]. The improvement in mechanical properties of the propellant by