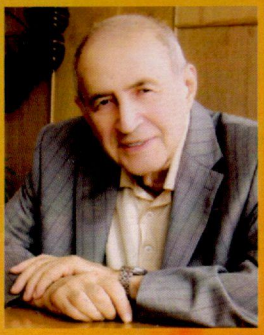

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THE EFFECT OF VARIOUS METAL OXIDES OF AN/MGAL - BASED GAS GENERATOR

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Ammonium nitrate (AN)/MgAl - based gas generator have several major problems, namely, a low burning rate, poor ignitability, low energy, and high hygroscopicity. The gas generating composition includes ammonium nitrate as an oxidizer, MgAl (50/50) mechanical alloys as a fuel, paraffin as a binder and metal oxides as a catalyst.

Ammonium nitrate (AN) finds widespread application as both a fertilizer and a component of a variety of energetic compositions, mainly industrial explosives. AN is also used as an oxidizer in propellant formulations, but not so extensively as in explosive compositions. AN is hygroscopic, has rather low energy content, exhibits several crystalline phase transitions at temperatures within the range of normal usage, and endows AN-based propellants with a limited range of burning rates. For these reasons, ammonium nitrate has been used mainly in gas generators and other auxiliary power sources. However, ammonium nitrate is a very cheap, readily available, and safe energetic material that can be phase stabilized. It produces environmentally friendly and smokeless combustion products, which is an important feature. The current need for clean propellants to satisfy the high demand for automobile air bag systems gives rise to a new interest in AN combustion studies [1]. MgAl alloy as a fuel in solid propellants is thought to be effective in providing flexible and high performance characteristics of solid motor. It is known that the melting and ignition temperatures of MgAl alloy are essentially lower as compared with those for pure metals. For example, when Mg content in alloy in the range 37-65% mass, the melting temperature of alloy is about 720K [2]. Ignition of MgAl particles heated on the hot plate in air occurs at the temperature about 1100 K instead of 2300 K for pure Al. Disruption of the mother particle and formation of small daughter particles accompany the combustion of MgAl particles in oxidizing gas environment[3].

Each gas generator strand had a diameter of 6 mm and a length of 10 mm. The burning behavior was investigated in a chimney-type strand burner pressurized with nitrogen gas. Each strand was ignited by applying 20 V to an electrically heated nichrome wire attached at the top. Each gas generator strand was combusted in a pressure range from 1 to 5 MPa. The burning phenomenon of the gas generator was recorded by a high-speed video recorder. The captured videos were used to measure

the burning rates. The regression length of the burning surface was measured with a resolution of 0.01 mm.

The addition of a burning catalyst proved to be effective in improving the burning characteristics of AN/MgAl-based gas generator. In this study, the burning characteristics of AN/MgAl-based gas generator addition various metal oxides (TiO_2, Cr_2O_3 and ZrO2) as a burning catalyst were investigated. The additions of various metal oxides are known to improve the ignitability at low pressure and increased burning rate. The use of mechanical alloy MgAl as an oxidizer allowed gas generator ignited at low temperatures.

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