

SPACE PROPULSION SYMPOSIUM (C4)
Propulsion System (2) (2)

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EXPERIMENTAL STUDY OF COLLISION OF AL/AL₂O₃ CONDENSED PARTICLES AT VARIOUS
VELOCITIES BY AN INNOVATIVE METHOD**Abstract**

An experimental investigation is conducted to determine the collision of Al/Al₂O₃ condensed particles for aluminized composite propellant by means of an innovative apparatus at various impact velocities. Based on theoretical analysis of droplets collision, an experimental research method for studies on collision of condensed particles is proposed, and an innovative experimental apparatus is designed and produced. With no change of diameter distribution of condensed particles before collision, experiments of condensed particles collision are carried out at various relative velocities by changing the impact angle of two particles streams. The morphology, ingredient and size of the collected particles are analyzed with the aid of scanning electron microscope, X-ray powder diffraction (XRD) and Malvern Mastersizer 2000. It is found that particles of various sizes are spherical with diameter distributing from 0.03 μm to 200 μm . The component analysis shows that collected particles mainly contain Al₂O₃ and aluminum. About 10%-27.9% of aluminum in the products do not combust. In addition, for the relative velocities of collision range from 31 m/s to 81.9 m/s, the mean particle diameter d_{43} and d_{50} decreases after collision. Fragmentation is generally the outcome of collision. Furthermore, collision causes fragmentation of particles with diameter larger than 10 μm and reduction in volume fraction. Collision causes little volume fraction changes for particles with diameter of 2-10 μm , but results in significant volume fraction increases for particles with diameter smaller than 2 μm .