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NASA TECH BRIEF

A Comparison of Two Methods of Measuring Particle Size of Al_2O_3 Produced by a Small Rocket Motor

Knowledge of the size of the particulate effluent of solid propellant rocket motors containing aluminum as a fuel additive allows prediction of thrust loss due to particle lag, the particulate radiant heat transfer, the particulate acoustic attenuation, particle impingement, and the rocket plume structure and properties.

Study of the particle size of the Al_2O_3 produced by a small rocket motor as determined by tank collection and by spectrophotometric tests helps to explain a previous discrepancy and to realize the potential of using both of these methods of size measurement in a complementary manner.

Principal variables in the tank collection tests performed are tank volume, aluminum loading in the propellant, and chamber pressure. Various mean diameters, moment ratios, and the mass median diameter are factors used for analysis of particle size data from these tests. By defining the mean size in terms of low moments of the distribution function, the tank collection tests give internally consistent results. Particle size is independent of receiver tank capacity, independent of aluminum concentration within the propellant, and weakly dependent on rocket motor chamber pressure.

Aluminum content and chamber pressure are the principal variables in spectrophotometric tests performed at three wavelengths on rocket motors. Interpretation of the transmission measurements with internal consistency is possible by postulating that the size distribution is bimodal. Results of these tests agree with those of the tank collection tests, namely, that particle size is independent of aluminum concentration within the propellant and weakly dependent on rocket motor chamber pressure.

Note:

Requests for further information may be directed to:
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No patent action is contemplated by NASA.

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