66th International Astronautical Congress 2015

SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations (IP)

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CENTRAL BINARY COLLISION OF POWER-LAW MODEL GEL PROPELLANT DROPLETS: EFFECTS OF N AND K ON MAXIMUM DEFORMATION

Abstract

The increasing demand for high energy density fuels and the concern for their safety have propelled research in the field of gelled propellants. Despite their potential advantages, compare with liquid propellants, gelled propellants have more complex atomization and burning characteristics. Numerical simulation on central binary collision of power-law model gel propellant droplets is conducted to investigate the effects of n and K (K is the consistency index, whereas n gives the power-law index of the fluid) on the maximum deformation amplitude using a VOF (Volume of Fluid) method. The numerical computation model is validated by comparing with experimental data in the literature. The numerical results show that the maximum deformation amplitude decreases and appears early with increasing n and K value; Moreover, the relation between maximum deformation and Weber number can be well fitted by linear correlation. The dissipation loss coefficient is not only dependent on Reynolds number, but also n and K, moreover, dependence of Reynolds number decreases while dependence of n and K becomes significant with increasing Reynolds number.