MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Science Results from Ground Based Research (4)

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IGNITION OF FUEL SPRAY NUMERICAL SIMULATION

Abstract

The paper presents the results of developing of physical and mathematical model making it possible to take into account the effect of droplets non-uniformity in space and size distribution on ignition conditions for fuel sprays. The influence of condensed phase volume fraction on ignition and combustion of sprays was studied, physical and mathematical models for multi-phase flows, mixture formation and combustion of liquid fuels based on solving Navier-Stokes equations for gas phase accounting for thermal and mechanical interaction with poly-dispersed droplets array. The problems of particulate phase dynamics are regarded accounting for the interaction with gas phase atomization, evaporation and combustion. It was shown that depending on droplet size distribution and aerosol cloud density different flow scenario were possible. Combustion in terrestrial conditions is strongly affected by thermogravitational instability, which provides additional very effective mixing of the components and formation of combustible mixture in the vicinity of each droplet. On the contrary, this mechanism does not work under low gravity conditions. Only diffusion contributes to mixing, which makes ignition and combustion conditions less favorable.