SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

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CARDC-SBM SPACECRAFT BREAKUP MODEL AND ITS APPLICATION

Abstract

Study and modeling on spacecraft breakup debris characteristics was one of the main interesting fields of the HVI team of China Aerodynamics Research and Development Center (CARDC) in past five years. Totally six hypervelocity impact tests on simulated spacecrafts for breakup modeling were conducted at hypervelocity ballistic ranges of CARDC. Tens of thousands of breakup fragments were collected by soft materials, with wide range of debris mass, size and area data. The spacecraft breakup results in different impact conditions were studied by tens of numerical simulation cases. Based on these test and numerical data, breakup threshold function, debris size distribution function and debris area-to-mass distribution function for spacecraft breakup were developed. Recently, a debris velocity distribution function was established based on numerical results. The assembly of these four functions mentioned above is named as CARDC-SBM spacecraft breakup model. In this paper, the data source and model formulation of the CARDC-SBM model are described in detail, and then the typical spacecraft breakup events are analyzed by using the model. In addition, the comparison between the CARDC-SBM model and the widely used NASA Standard Breakup Model is presented, and the characteristics of both the two models are analyzed.

Key words: Spacecraft; Hypervelocity impact; Breakup model; Space debris