

[Hide Expanded Menus](#)

职世君, 孙冰, 张建伟. 基于细观颗粒夹杂模型的固体推进剂导热系数预测[J]. 航空动力学报, 2013, 28(5): 1187~1191

基于细观颗粒夹杂模型的固体推进剂导热系数预测

Estimation of thermal conductivity of solid propellants based on particle packing model

投稿时间: 2012-05-31

DOI:

中文关键词: [固体推进剂](#) [细观力学](#) [导热系数](#) [数值模拟](#) [分子动力学](#)英文关键词: [solid propellant](#) [mesomechanics](#) [thermal conductivity](#) [numerical simulations](#) [molecular dynamics](#)

基金项目: 航天科技创新基金(CASC201103)

作者	单位
职世君	北京航空航天大学 宇航学院, 北京 100191
孙冰	北京航空航天大学 宇航学院, 北京 100191
张建伟	北京航空航天大学 宇航学院, 北京 100191

摘要点击次数: 206

全文下载次数: 263

中文摘要:

为准确预测固体推进剂的导热系数, 采用了分子动力学方法对高填充比固体推进剂细观模型进行建模. 利用有限元理论对固体推进剂细观模型稳态热传导进行计算, 结合计算细观力学均匀化方法, 计算了固体推进剂细观模型的均匀温度和热流密度. 根据计算所得的平均温度和平均热流密度值求解稳态热传导方程, 得到了两相和三相固体推进剂的宏观等效导热系数. 其中, 两相固体推进剂的仿真结果与试验结果的误差只有3.63%. 结果表明: 在预测固体推进剂导热系数时, 采用固体推进剂的颗粒夹杂模型可以充分考虑粒径大小、颗粒随机分布的影响, 更真实地反映固体推进剂的微结构特征, 计算结果准确可靠.

英文摘要:

To better estimate the thermal conductivity of solid propellants, the molecular dynamics method was adopted to match the size distribution and volume fraction of solid propellants. The finite element method was employed to compute the steady heat conduction of solid propellant meso-scale models. According to the homogenization method, the mean temperature and mean heat flux were calculated. Based on the mean temperature, mean heat flux and steady heat conduction equation, the effective thermal conductivities of two- and three-phase solid propellants were obtained. The error between the simulation result and test data of two-phase solid propellants is only 3.63%. The results show that the effects of particle size and random distribution of particles can be fully considered when the particle packing model is employed in the process of estimating the thermal conductivity of solid propellants. The particle packing model is more consistent with the micro-structural features of real solid propellant, and the results are accurate and reliable.

[查看全文](#) [查看/发表评论](#) [下载PDF阅读器](#)