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反应NH~4ClO~4+Mg+K~2Cr~2O~7的非线性化学动力学2: 固相 振荡燃烧的化学模 型

冯长根,刘赵淼,曾庆轩,徐世英

北京理工大学力学工程系国家重点实验室

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摘要 建立了NH~4ClO~4+Mg+K~2Cr~2O~7固相振荡燃烧体系的非吸热三变量立方自催化化学模型,应用非线性数学分析方法,研究了固相振荡燃烧的非线性化学动力学机理,并对此进行了数值模拟,结果反映了这一振荡燃烧体系所具有的非线性化学动力学特性。

关键词 高氯酸铵 镁 重铬酸钾 反应动力学 反应机理 化学振荡 数值模拟

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The nonlinear chemical reaction kinetics of NH~4ClO~4+Mg+K~2Cr~2O~7 2: Chemical models of the solid phase oscillatory combustion

Feng Changgen,Liu Zhaomiao,Zeng Qingxuan,Xu Shiying

Abstract The non-isothermic three-variable chemical model of the oscillatory combustion of NH~4ClO~4+Mg+K~2Cr~2O~7 system is established in the present paper. The nonlinear reaction kinetic character of this system is described by the results of numerical simulation. By applying mathematical methods for nonlinear analysis, the mechanism of the nonlinear chemical kinetics of the solid phase combustion is studied. The results show that the system has rich content of the character of the nonlinear chemical kinetics. From the result of numerical simulation it can be seen that with the changing of the value of the nondimensional variable μ of NH~4ClO~4 when μ is between μ=0.00547863 and μ=1.47185, the oscillatory period is different. When μ=0.5678, 0.591, 0.6378, 0.6388 and 0.6478, the period -1, period -2, period -4, pseudo-period and period -3 oscillations are obtained respectively. It can be recognized that the change of NH~4ClO~4 has influence on the oscillatory period. The result of numerical simulation is same to the reaction mechanism analysis of the experimental study. The non-isothermic three-variable chemical model studied in the paper not only considers the influence of concentration on the oscillatory period, but also analyzes the effect of temperature on the oscillatory combustion. The nonlinear numerical analysis method is combined with the chemical kinetics reaction mechanism analysis of the pyrotechnics combustion in the present paper. And the experimental and chemical models study are developed.

Key words AMMONIUM PERCHLORATE MAGNESIUM POTASSIUM DICHROMATE REACTION KINETICS REACTION MECHANISM CHEMICAL OSCILLATIONS NUMERICAL SIMULATION

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通讯作者