针板电极荷电液体射流不稳定性分析Analysis of Instability for Charged Liquid Jets with the Needle-plate Electrodes

汪朝晖 廖振方

重庆大学

关键词：　　液体射流 不稳定性 静电场 针板电极 色散方程

摘　要：　　基于荷电液体射流的模型和广义坐标下的Lagrange方程，建立了静电场作用下无粘性液体射流的色散方程，并对该方程进行了数值求解，分析了若干因素对荷电液体射流的轴对称模型和非轴对称模型的影响。研究结果表明：随着电场强度的增大，荷电液体射流的最大扰动增长率增大。低电压时静电场对轴对称射流的不稳定性有显著作用，电压逐渐升高时非轴对称模型逐渐占据主导地位，最终导致液滴的破碎；随着射流半径的减小，荷电液体射流的不稳定性增加，轴对称模型下射流半径的改变对射流不稳定性的影响比非轴对称模型小；不同的液体介质对荷电液体射流不稳定性的影响在非轴对称模型下表现得更为显著。Based on the models of charged liquid jets and Lagrange equation under the generalized coordinate, the dispersion equations of inviscid liquid jets in an electrostatic field were established and solved by using the numerical methods. According to analyzing the calculated values, the effects of different factors on axisymmetric models and non-axisymmetric models of charged liquid jets were studied. The results showed as follows. The maximum value of the disturbed growth rate of charged liquid jets is increased with the stronger electric field intensity. When the voltage is lower, the electrostatic field has a significant effect on the axisymmetric instability models. The non-axisymmetric instability models exert a dominant influence since the voltage is enhanced gradually in an electrostatic field and it leads the droplets to break up finally. Instability of charged liquid jets is increased as the jet radius reduces. The changes of the jet radius in the non-axisymmetric modles have more effects on the instability of charged liquid jets than in the axisymmetric models. The effects of different liquid dielectrics on the non-axisymmetric charged liquid jets instability become very obvious.

查看全文（请使用Adobe Acrobat 6.0版本浏览） 返回首页 引用本文