

双流体荷电喷雾结构的PIV测量 Measurement of Twin-fluid Electrostatic Spray Structure by Using PIV

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关键词: 荷电喷雾 粒子图像速度场仪 测量 喷雾结构

摘要: 在荷电喷雾流动中, 高压静电场产生的库仑力、极化力与流体力耦合作用在雾滴上, 从而对带电雾滴的运动特性产生显著影响, 在射流边缘区域出现卷吸作用而产生涡旋流动。为了对双流体荷电喷雾结构进行分析, 探讨雾滴荷电对喷雾结构的影响以及由此产生的传热、传质强化作用, 利用粒子速度场仪测量了石灰浆液双流体荷电喷雾流动流场。用图像采集卡将CCD相机拍摄的流动图像实时传送并储存到计算机中, 采用TSI公司Insight 3.3软件对喷雾图像进行处理和分析。试验结果表明: 双流体荷电喷雾流动结构具有明显不同与非荷电喷雾的特点, 射流流动在库仑力、极化力等电场力的作用下形成具有明显特征的4个区域: 主射流区、上卷吸区、下卷吸区和影响区。双流体荷电喷雾从单一的卷吸现象形成了较为复杂的涡旋结构, 有利于增强雾滴与周围气相介质的接触, 增强雾滴传热传质能力。 In electrostatic charged spray, the electrostatic and polarization forces produced by high electrostatic field coupled with fluid forces act on the droplets which has a marked effect on the motion characteristics of the droplets. To analyse the charged twin-fluid spray structure, the effects of electrification on spray structure and aggrandizement of heat and mass transfer were discussed. Furthermore, PIV technology was employed to measure the gas-liquid twin-fluid electrostatic spray, and the collected flow image was send to the computer via data line by the image grabber card. The spray images data were analyzed by using Insight 3.3 software and then flow velocity and streamlines were gained. The experiment results indicated that the twin-fluid electrostatic spray has the special spray flow structure. The distinctly different structures with main jet flow section, up convolution section, down convolution section and influence section in the spray flow field were formed. The complicated eddy current effect comes into being in the twin-fluid electrostatic spray from single convolution phenomena, which could make the droplets contact with gas medium easy, and enhance the droplets absorbency.

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