中国化学工程学报 2003 11 (6): 633-637 ISSN: 1004-616x CN: 44-1063/R

SELECTED PAPERS IN COMMEMORATE

旋风分离器内旋进涡核的PIV显示

吴小林, 时铭显

Department of chemical engineering, University of Petroleum, Beijing,102249, China

收稿日期 修回日期 网络版发布日期 接受日期

摘要 The precessing vortex core (PVC) in a cyclone separator plays an important role in the separation performance and in further understanding of the general law of periodic unsteady flow therein. In this paper, theunsteady flow field is investigated with particle image velocimetry (PIV), and the instantaneous velocity, vorticity,tangential velocity, and radial velocity are acquired by analyzing the images of instantaneous flow. It is for the first time reported that there is a centrifugal flow region close to the dust discharge zone and its maximum value is higher than the mean radial velocity. This discovery is very important for understanding the principle of separation of particles in the area of dust discharge. Determination of the frequency and amplitude of PVC was conducted in the region where the phenomenon of PVC is remarkable. Results agree well with those obtained by hot wire anemometry. The observations of the center of vortex core and the bimodal distribution of the amplitude of the PVC indicate the vortex core precesses around the geometric axis of the cyclone in its own way.

关键词 cyclone separator flow field instantaneous velocity precessing vortex core particle image velocimetry
分类号
DOI:

Visualization of the Precessing Vortex Core in a Cyclone Separator by PIV

WU Xiaolin, SHI Mingxian

Department of chemical engineering, University of Petroleum, Beijing, 102249, China

Received Revised Online Accepted

Abstract The precessing vortex core (PVC) in a cyclone separator plays an important role in the separation performance and in further understanding of the general law of periodic unsteady flow therein. In this paper, theunsteady flow field is investigated with particle image velocimetry (PIV), and the instantaneous velocity, vorticity,tangential velocity, and radial velocity are acquired by analyzing the images of instantaneous flow. It is for the first time reported that there is a centrifugal flow region close to the dust discharge zone and its maximum value is higher than the mean radial velocity. This discovery is very important for understanding the principle of separation of particles in the area of dust discharge. Determination of the frequency and amplitude of PVC was conducted in the region where the phenomenon of PVC is remarkable. Results agree well with those obtained by hot wire anemometry. The observations of the center of vortex core and the bimodal distribution of the amplitude of the PVC indicate the vortex core precesses around the geometric axis of the cyclone in its own way.

Key words cyclone separator; flow field; instantaneous velocity; precessing vortex core; particle image velocimetry

通讯作者:
吴小林 wuxl@bjpeu.edu.cn
作者个人主页: 吴小林; 时铭显