

传递现象

连通容器气体爆炸流场的CFD模拟

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摘要 跟单个容器或管道相比, 连通容器内气体爆炸会导致较高的爆炸压力和压力上升速率, 以至于很多装置或设备不能承受而造成人员伤亡和财产损失。连通容器内气体爆炸强度增加主要是跟气体流动与燃烧过程有关, 研究该类气体爆炸机理就必须从爆炸流场着手。本文利用大型计算流体力学软件 FLUENT 对气体爆炸流场进行了数值模拟, 获得了气体爆炸流场中温度、压力、速度、密度和燃烧速率随时间的变化规律, 模拟结果能够比较清晰地反映出气体爆炸的整个过程。研究表明, 连通容器中气体燃烧和流动引起未燃气体的压缩和湍流以及湍流诱导的喷射燃烧是系统中气体爆炸强度增加的主要原因, 而管道在湍流诱导的喷射火焰中扮演非常重要的角色。

关键词 [连通容器](#); [气体爆炸](#); [爆炸流场](#); [CFD模拟](#)

分类号

CFD simulation on gas explosion field in linked vessels

Abstract

Compared with a single vessel or pipe, gas explosion which happens in linked vessels often causes high pressure and high rate of pressure rise which are intolerable by most industrial equipment. The increment of gas explosion strength in linked vessels is related with the state of gas flow and turbulent combustion. In order to reveal the mechanism of higher gas explosion strength and characteristics of flame and pressure transmission in linked vessels, the characteristics of gas explosion field must be found out. In this paper, the changes of temperature, pressure, velocity, density and reaction rate with time were obtained by CFD (computation fluid dynamics) investigation of the gas explosion field in linked vessels with the software FLUENT. The results could describe clearly the whole process of gas explosion. The results also suggested that the compression and turbulence of unburned gas caused by flow and combustion of gas mixture and the jet fire induced by turbulent flow played a significant role in the enhancement of gas explosion strength in linked vessels. The pipe which connected the vessels had great effect on the development of turbulent flow and jet fire.

Key words [linked vessels](#) [gas explosion](#) [explosion field](#) [CFD simulation](#)

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