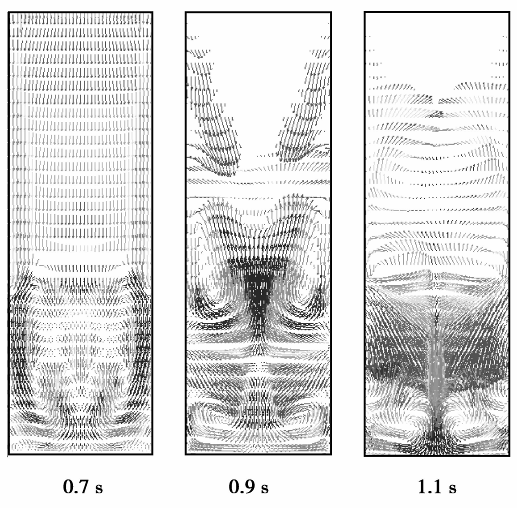

图 4 颗粒流场速度分布

Fig.4 Velocity maps

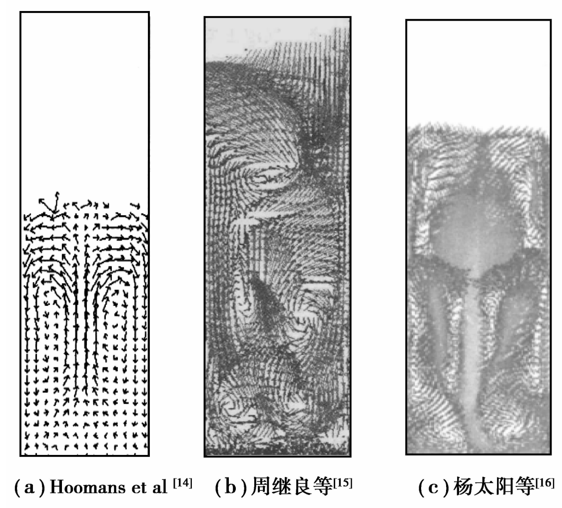

图 5 相关研究结果

Fig.5 Ralated research results

从图 6 可知,钛渣流态化下床层的气泡直径随着床高的增加在不断增加,气泡尺寸与距分布板距离近似呈线性函数关系,玻璃珠床实验值拟合的线性函数关系为 $d=0.618\ 5\ h-2.995$,线性拟合度达到 98.05%;同时,Price 等[18]和 Fan 等[19]也做了相似的数值实验研究,文中数值实验结果与他们的研究结果一致。

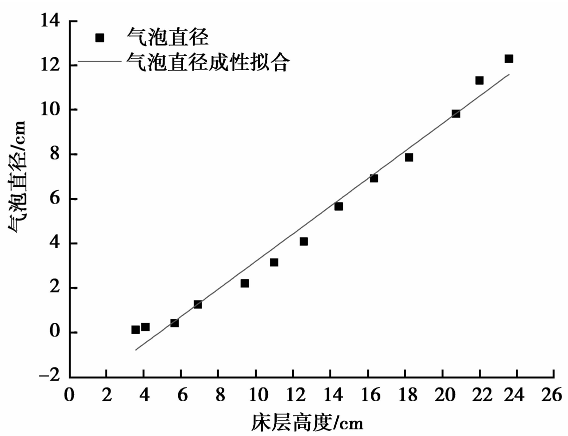

图 6 气泡直径随分布板距离变化

Fig.6 Relationship bubble diameter with vertical distance along the distributor

4 结 论

文中以双流体模型为基础研究了钛渣流动特性数学模型;结合钛渣的物性,采用传统的经验公式计算了钛渣流态化系统的最小流化速度、完全流化速度。研究钛渣在最小流化速度和完全流化速度下的流动特性。研究结果表明:

1)以双流体模型为基础得到的钛渣流动特性数学模型,成功地模拟出了钛渣流态化氯化的流动特征,为反应器设计提供数值模拟基础。

2)B 类颗粒的钛渣最小流化速度数值模拟结果显示,Wen-yu 预测公式整个床层基本出现的是乳相,而 Grace 修正公式在 0.7 s 时能够成功地模拟出床层气泡行为。

3)完全流态化时,数值模拟表明钛渣床层首先要经历一个节涌过程,然后再进入完全流化状态。

4)完全流化状态下,文中数学模型对于钛渣流态化床层中固体矢量图和气泡尺寸大小变化规律的预测均与相关文献研究结果一致,表明该数学模型适合钛渣流态化氯化过程数值模拟。

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