Comparison between electrical resistance tomography and CFD and other measurement techniques for gas-liquid mixing

Authorship: J. Ritson[1], K Primrose[1],C Qiu[1], D Brown[2], D Kubicki[2], M Wang[3]

Authors' affiliation(s) [1]Industrial Tomography Systems plc, [2]BHRG,
[3]University of Leeds

Abstract

Many industrial processes use stirred tank reactors which involve complex multiphase flows. These require an impeller system to handle liquids, sparged gas, boiling fluids, slurries and heat transfer. There are many designs of such systems and it is extremely challenging to optimise these designs for the wide range of process conditions involved.

One method of design and optimisation is through the use of computational fluid dynamics (CFD). Whilst CFD operates extremely well for single phase systems, it becomes more challenging for multi-phase systems such as gas-liquid and solid-liquid mixing. Improvements to CFD code and a robust operating platform would offer considerable benefits to the operation of many processes in the pharmaceutical, fine chemical and other sectors.

Two electrical tomography systems have been tested. The p2000, which has been applied in a wide variety of previous studies, and the newly developed rapid impedance tomography system (z8000) which has frame rates in excess of 1,000 dual frames per second. These have been used to investigate a model highly gassed stirred tank reactor and applied to test state of the art CFD predictions of gas distribution.

We will report on the results of these studies, presenting how new tomographic measurement techniques compare with CFD modelling methods for such challenging systems. In addition, novel software for cross-correlation techniques and full vessel 3D images will be presented.