THERMAL SCIENCE
International Scientific Journal

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MODELLING OF BUBBLE BREAK-UP IN STIRRED TANKS

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ABSTRACT

The Lagrangian code LAG3D for dispersed phase flow modeling was implemented with the introduction of bubble break-up model. The research was restricted on bubbles with diameter less than 2 mm, i. e. bubbles which could be treated as spheres. The model was developed according to the approach of Martinez-Bazan model. It was rearranged and adjusted for the use in the particular problem of flow in stirred tanks. Developed model is stochastic one, based on the assumption that shear in the flow induces the break of the bubble. As a dominant parameter a dissipation of the turbulent kinetic energy was used. Computations were performed for two different types of the stirrer: Rushton turbine, and Pitch blade turbine. The geometry of the tank was kept constant (four blades). Two different types of liquids with very big difference in viscosity were used, i. e. silicon oil and DMSO (DiMethylSulfOxide), in order to enable computation of the flow in turbulent regime as well. As a parameter of the flow, the number of rotations of the stirrer was varying. As a result of the computation the fields of velocity of both phases were got, as well as the fields of bubble concentration, bubble mean diameter and bubble Sauter diameter. To estimate the influence of the break-up model on the processes in the stirred tank a computations with and without this model were performed and compared. A considerable differences were found not only in the field of bubble diameter, but also in the field of bubble concentration. That confirmed a necessity of the introduction of such model. A comparison with the experiments performed with PDA (Phase Doppler Anemometry) technique showed very good agreement in velocity and concentration profiles of the gas phase. The results for the average bubble diameter are qualitatively the same, but in almost all computations about 20% smaller bubble diameter was got than in the measurements.

KEYWORDS

multiphase flow, turbulence, bubbles, break-up, stirred tank, model, experiment

PAPER SUBMITTED: 2004-02-05
PAPER REVISED: 2004-03-18
PAPER ACCEPTED: 2004-04-23

THERMAL SCIENCE YEAR **2004**, VOLUME **8**, ISSUE **1**, PAGES [29 - 49]

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