XX Fluid Mechanics Conference KKMP2012,
Gliwice, 17-20 September 2012

INVESTIGATIONS OF GAS BUBBLE FORMATION BY MEANS OF THE OPTICAL TOMOGRAPH

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Key words: bubble formation, bubble flow, optical tomography

Introduction

Design engineers working on aerators, especially pressure aerators have to know mechanisms of bubble formation. In pressure aerators, the gas is forced under pressure into the liquid by diffusers equipped with a system of jets generating fine gas bubbles. Depending on the jet diameter, the generated bubbles have different shapes and concentrations. In the case of low rates of gas outflow from the jet, bubbles are ball-shaped and they form at the jet edge (e.g. Orzechowski, 1990). In practice, such phenomena occur only for the gravitational outflow of gas. As the gas outflow intensity increases, diameter of the forming gas bubble depends not only on the hole diameter but on the value of volumetric intensity of the gas flow as well.

The paper presents investigations of the forming gas bubbles at the jet with the hole mm, located in the bottom of the round column 80 mm in diameter. Volume of the forming bubbles was measured by means of the optical tomograph with five projections (e.g.: Rząsa et al., 2007, Rząsa et al., 2003). The test results were compared with theoretical relationships known from literature (e.g.: Dziubiński et al, 2010).

The test results

Fig.1 shows results of measurements of the gas stream getting out the jet. In the case of very low intensities of the flow, the bubbles form packages (some or several bubbles). As the gas flow increases, breaks between successive package become shorter. None significant changes in size of the forming bubbles are observed, only their number in a package increases. As for the gas streams above 1 cm^3/s, package formation decays. A small bubble at the package end breaks away from the jet. Increasing the gas stream, we can lead to regular bubble formation at the same time intervals (2 cm^3/s). For such forming bubbles we can see influence of changes of the gas flow intensity on size of the forming bubbles. Further increase of the gas stream causes visible deformations of the bubble shapes as a result of dynamic forces action. In a consequence, it leads to formation of bubble packages again, however their size strongly depends of the gas stream (2 cm^3/s). Like in the case of small gas streams, there is such a stream value when the packages decay, and bubbles do not form at the jet end, but at a certain distance from it (4.65 cm^3/s). Wymiary tworzących się pęcherzyków nie zależą od średnicy dyszy a jedynie od strumienia gazu. In the case of the streams above 5.3 cm^3/s we can observe turbulent bubble formation, leading to the next package flow, but time between packages is very short.

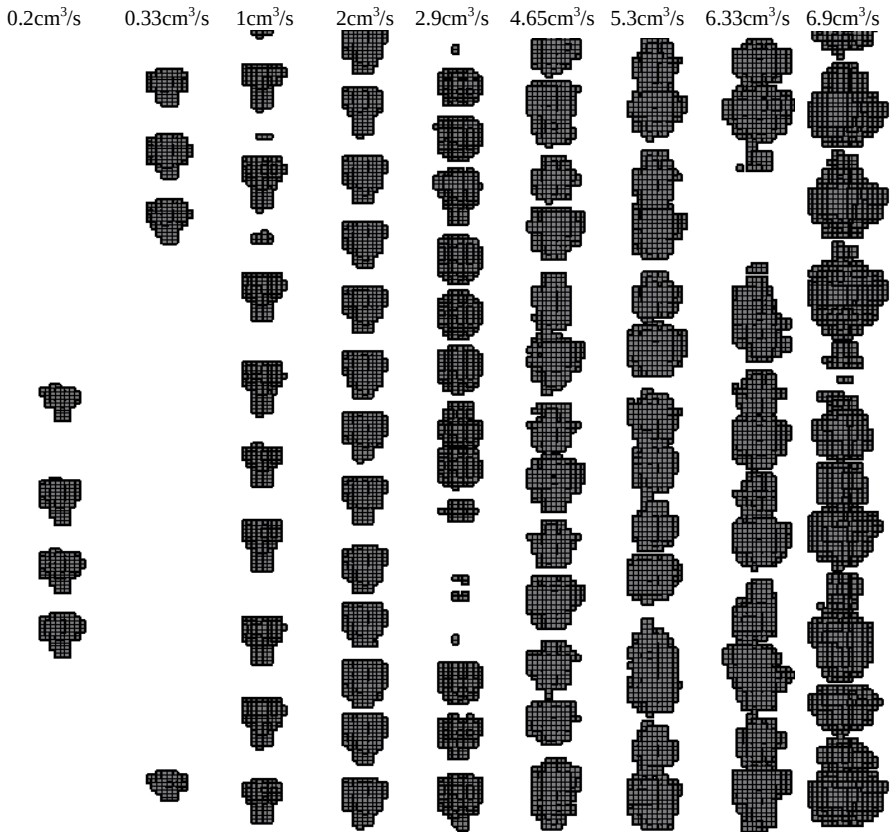

Fig. 1 Results of gas bubble measurements for different flow streams

Summary

The results of measurements of the bubble volume were compared with the results of calculations based on theoretical models. The results were compared with the models proposed by Davidson-Schuler (e.g.: Davidson et al, 1960) and Ramakrishnan-Kumar-Kuloor (e.g.: Kumar et al, 1970). The theoretical results are different. However, the experimental results are included between divergences of the theoretical models. Thus, the models seem to be right and their convergence with theoretical data.

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