Comparison Between Turbulent and Laminar Bubbly-Flow for Modeling H2/H2O Separation

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Abstract

Hydrogen production by water electrolysis combined with renewable energies, is one of the most environmentally-friendly method, compared with traditional technologies based on fossil fuels since no CO2 emissions are generated. One of the most critical aspects on water electrolysis is gas-liquid separation, especially in systems with an electrolyte being recirculated by a pump (forced convection). The main problem of this kind of circulation is that a gas fraction could return to the electrolysis circuit, which may have undesirable consequences, such us the formation of explosive mixtures and pump damages. A suitable design of separator devices could be a solution in order to avoid a gas return to the electrolysis circuit. In this sense, the use of gas traps or deflectors might reduce hydrogen suction by pump action. At this stage, COMSOL Multiphysics becomes a useful design tool to test the good performance of deflectors. Present work reports a comparison of a standard separator (Figure 1A) and a novel separator design proposed by CNH2 (Figure 1B). The aim is to evaluate whether the introduction of gas traps is a suitable strategy for reducing or avoiding gas returning, therefore increasing the separation efficiency while avoiding the above mentioned problems.

Figures used in the abstract

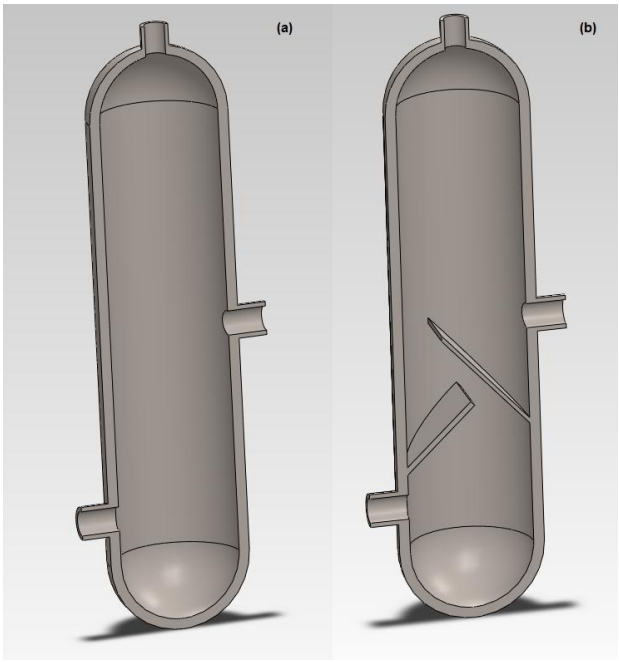

Figure 1: A) Standard Separator; B) Proposed Design.