Simulating Liquid and Bubble Dynamics in PEM Water Electrolysis

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Polymer Electrolyte Membrane Water Electrolyser (PEMWE) offer to utilize intermittent electrical energy from solar and wind energy suitably converted and stored in energy carriers such as hydrogen. The performance and efficiency of PEMWE is directly depends on the bubbles as it blocks the electrode surface and lowering the interfacial mass and heat transfer. Therefore, in the present study anode side gas-liquid two phase flow in PEMWE is analyzed using three-dimensional, transient, computational fluid dynamics (CFD) simulation. In the present work, two CFD were developed: single phase flow model for study influence of inlet-outlet configuration using uniformity index and two-phase flow model for studying the influence of dispersed bubble dynamics. Hydrodynamics of gas-liquid flow were simulated using Euler- Euler based two fluid model approach with population balance model to account for bubble size distribution, coalescence and breakup effect. Overall, this study provides important guidelines to properly design the PEM Water Electrolysis from laboratory scale to pilot scale.