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Boundary-value Problems in Reactive Gas Absorption

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Abstract

Generalized mathematical formulations and closed-form approximate solutions are presented for two nonlinear boundary-value problems in reactive gas absorption. In the first part, the problem of gas absorption, through a spherical gas-liquid interface, accompanied by 2nd-order chemical reaction in the liquid phase is analyzed by means of numerical and approximate solutions. It is shown that bubble sphericity could enhance appreciably gas absorption due to chemical reaction, depending on the magnitude of system parameters. It is also shown that the spherical effect is unlikely to be significant in industrial gas-liquid reactors. In the second part, the problem is addressed of gas absorption, through a plane interface, accompanied by a 2nd-order reaction with a volatile liquid reactant. An analytic approximate solution is developed which is applicable in all reaction regimes. The solution is accurate, simpler, and numerically more stable than other solutions reported in the literature.