Development of Rare Earth Solvent Extraction Process Simulation

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In this study, a new simulator is developed to solve the thermodynamic equilibrium equations to separate desired rare earths from multi-components rare earth solution. Because the thermodynamic equilibrium equations have a huge number of variables, it is extremely hard to solve the nonlinear equations in a numerically stable manner due to the initial value problem and divergence problem of the equation solver. So, new model reduction method is devised to overcome the numerical problems by reducing the number of the equations. The new process simulator equipped with the new model reduction method can estimate successfully all the concentrations of all the stages in the solvent extraction process without any numerical problems. Also, user can set all the parameters related to the thermodynamic equilibrium, the process geometry and the operation conditions in a convenient way. The simulator enables users to perform sensitivity analysis with predicting the performances and behaviors of the solvent extraction with respect to the changes of the process geometry and the operation conditions. Then, it is possible to obtain the optimal design parameters of the solvent process on the basis of the sensitivity analysis.