A Visualization Program of the Li Reduction Process for PWR Spent Fuel

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To predict the amounts of metals produced from the metalization process of PWR spent fuel, the GC code, which simulates the Li process, was developed[1] and a program, which is similar with it, was also developed recently[2-5]. Since the latter provides only the calculating results, it is necessary that the program is improved to one with a user-friendly interface. In this paper, the program was upgraded in order that users can not only accurately understand the metalization process by the Li reduction method but also access its input or output data easily.   The visualization program for simulating a metalization process of PWR spent fuel has been developed based on PV-WAVE[6]. This program is composed of two parts which are input menus and output windows. The first part is for inputting the information, such as data files and conditions, required for simulating the metalization process. The second part is for displaying the input and output data as a table, a graph, and a text form. Figure 1 shows the main window of the program. The following are the usage procedures for the developed program. 1) Data files, which are the spent fuel oxides, the gibbs free energy of each compound, and the chemical equations, are loaded. 2) Simulation conditions, which are the temperature, the amounts of LiCl, Li and Li_2O, and the number of batches, are entered. 3) The simulation is executed by clicking the EXECUTE button. 4) If one of the radio buttons in the left window is selected, its graph is displayed in the right window. 5) After the simulation execution, the output files are saved automatically and they are presented in the left list box. 6) When one of the result files is selected, its content appears in the right output window. This visualization program provides the amounts of products and the remaining reactants yielded for each batch and it also calculates the accumulated amounts of the compounds whose property is the LiCl rich phase. Figure 1 also shows the simulation result at the temperature of 650 ℃, LiCl of 4500 mole, Li of 350 mole, Li_2O of 0 mole, and the 300 batches case. The left graph is the input data and the right is the batch number vs the accumulated amounts of some compounds. The content of the result file selected in the list box is the equilibrium procedure of each spent oxide fuel by the Newton-Raphson method at the 1st batch.

In this paper, the recent developed program for numerically simulating the Li reduction process of PWR spent fuel was improved from its execution and data visualization aspects. It is possible that, through its interface, a user can directly set or control its condition variables and obtain the resulting data in various forms. It is also expected that this program could be applied to simulate the ACP process.
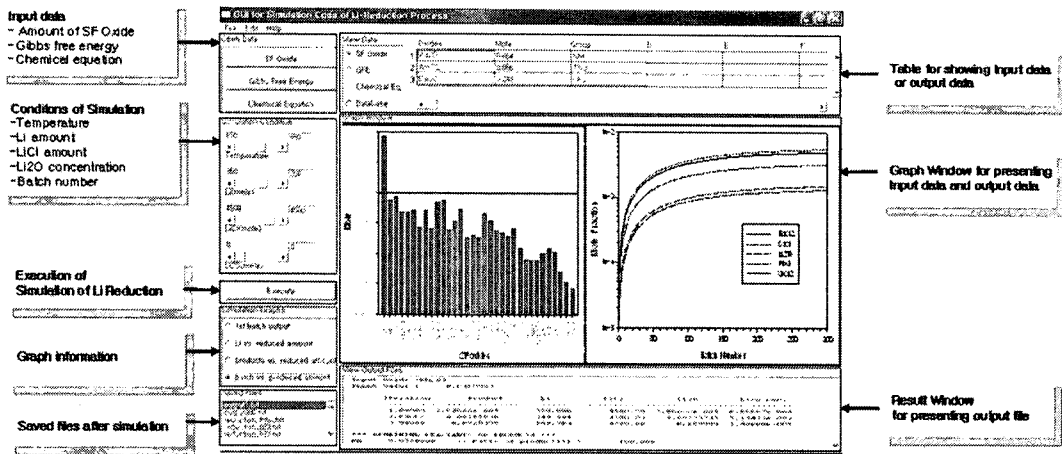
Figure 1. Main Window for the Simulation Program of the Li-Reduction Process.

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