# Development of New Advanced Simulation Technology for Cement Making Process

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## ABSTRACT

The cement clinker burning process is one of the key industrial processes in worldwide. It is therefore important to investigate the major and minor reactions in this process with respect to both their influence on the final product and the energy balance of the process.

Japanese Government, *METI* (Ministry of Economy Trade and Industry) is financially supporting “Innovative Fundamental Technology Development for Cement Making Project” which was started in2010. Final goal of this project is to accomplish 8% energy reduction in cement making process. Not only Ube Industries, but also, Taiheiyo Cement, Mitsubishi Materials and Sumitomo Osaka Cement have joined this project.

UBE plays a role of “Development of Simulation Technology” in this project, which can evaluate the energy consumption of the cement making process. To do this, correct treatment of many chemical reaction and heat balances in cement making process are required.

We used “FactSage”, one of the largest fully integrated database computing systems in chemical thermodynamics and “KilnSimu” simulation program for industrial rotary kiln system, as a cement process analysis tools in this project. “KilnSimu” uses “ChemApp” software to calculate the thermodynamic equilibrium of the chemical system.

In our study, roughly a hundred numbers of pure components, liquid slag and solid solutions has been considered. Furthermore, to estimate the temperature profile in the rotary kiln correctly, “Fluent”, a CFD code, has been used and coupled with “KilnSimu”. The coupled solution yields the enhanced accuracy in estimating the gas phase phenomena compared to one dimensional treatment in “KilnSimu” and detailed analysis of the pulverized coal burner area.

By using these simulation tools, effect of leakage air, fuel/air ratio, clinker cooler thermal efficiency and rotary kiln dimension are quantitatively examined. Among these factors, improvement of clinker cooler efficiency was most effective for energy reduction in the cement making process.