Biography

Pr. Lingai LUO is Research Director of French National Center for Scientific Research (CNRS). She was Direction member of LTEN and the director of LOCIE, both Laboratories of CNRS. She was the cofounder and coordinator of Sino-French Collaboratory for Environmental and Process Engineering and the director of its successor Sino-French Laboratory for Sustainable Energy of French CNRS and Chinese Academy of Sciences. She is mainly engaged in the intensification of heat and mass transfer and the efficiency optimization in different energy components, systems and processes. She has developed an original strategy on the optimization of energy systems by a multi-scale approach associated with an innovative method of optimized management of fluid distribution. Shi is the author of 3 books and over 130 journal articles. She is serving as subject editor of Energy Journal, and associate editor of three others Journals.

Title: **Energy efficiency optimization by a multi-scale approach**

A strategy of multi-scale approach for energy efficiency optimization of processes is presented. To improve the global performance, intensification should necessarily be implemented at three scales: local scale, component scale and system scale. The internal links between these scales should be carefully examined for performance maximization with minimum dissipative phenomena.

At the system scale, the optimization objective is to achieve a maximum efficiency with constraints. The problem consists in designing compact, integrated and multi-functional energy systems. At the component scale, optimization aims at maximizing its performance through innovative design. At the local scale, the intensification of heat and mass transfers through interfaces, the understanding and mastering of transfer mechanisms and the minimization of dissipations are at the heart of the problem. The problems of these three scales are closely coupled and interrelated. An energy system consists of a set of fluidic, thermal and reactive components. The efficiency optimization of such system depends on a global approach of analysis and action on both the quantity and quality of the energy involved in the system on the one hand, and on the optimization of the performances of each component and of each step on the other hand. In a multi-scale system, the global optimum is not necessarily the combination of the optima of the components taken separately. A key issue in the change of scales is to distinguish the design optima and the operating optima. In any case, the optimal performance of the components depends in turn on the mastering and control of the transport phenomena, as well as on the flow at the local scale. Furthermore, for the scale transition, structural, functional and temporal synergistic effects have to be carefully considered and optimized by appropriate scaling laws.