Iron and steel is one of the most important materials for the welfare of human being. However, huge energy is needed for manufacturing the materials and in addition this is owing to the problems that related to the most critical factors of iron and steel industry such as resources and environment. As you can see the explosive increase of iron and steel production in China, the growing of the industrial necessities requires serious attention to develop economically valuable and environmentally friendly processes. The innovation of ironmaking process is required for solving energy and environment problems over the world, such as the reduction of CO$_2$ emission and the decrease of quality of iron ores, etc. Then establishment and development of new fundamental technology in this industry become an urgent at these moments.

Japan’s iron and steel industry accounts for about 12% of its total energy consumption; about 65% of this figure is consumed by the BF process. If BF energy consumption is cut in half, the total energy requirements for the iron and steel industry may be reduced by 30% and nation’s total energy consumption by 3%. The BF has proven to be the most efficient ironmaking process in terms of high productivity and high energy utilization, but has not yield considerable energy savings.

The project on the innovation of ironmaking process by blast furnace for minimizing energy consumption and environmental influence has been promoted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) which approves the proposal of the Iron and Steel Institute of Japan (ISIJ). ISIJ has finished a five-year feasibility study (project leader: Prof. K. Ishii, Hokkaido University) from 1999 to build a new generation of blast furnace. The objective is to propose a new BF that consumes only half the energy, exhausts half the CO$_2$, produces hot metal with half impurities and generates half the slag compared with the conventional BF. 18 institutions, including 5 (4 after integration of NKK and KSC) major steelmakers, 11 universities, 1 independent administrative institute (after the national institute) and ISIJ are working on the project. The project is conducted by 4 groups as follows:

1) Acceleration of Reactions (leader: K. Ishii, Hokkaido Univ.)
2) Melting Temperature Lowering (leader: K. Nagata, Tokyo Institute of Technology)
3) Burden Refinement (leader: M. Shimizu, Kyushu Univ.)
4) Modeling (leader: J. Yagi, Tohoku Univ.).

In the present project, the excellent researchers on the ironmaking processes in Japan are joined and the concept and technologies for the innovation of blast furnace in 21 century is discussed from the wide and different view. Although many fundamental results emerge after hard study in the project, a part of them is presented in this special issue because of paper limitation. In order that the essential technologies studied in the project are in practical use and progress to a new process, we would like to ask all of readers for earnest discussions and serious opinions.