Remarks on Special Issue on Steel Products for Energy Industries

Nobuhiro FUJITA
Managing Executive Officer, Head of Laboratories
Steel Research Laboratories

Toward the realization of a carbon neutral society, the energy structure of the current society is greatly changing. Although the current energy system has relied on fossil fuels, the utilization ratio of renewable energy is expected to grow, and hydrogen and ammonia are expected to be used as energy carriers. Meanwhile, according to the policies of various countries, a carbon neutral society is expected to be established around 2050. During the transition period before carbon neutrality is achieved, the demand for fossil fuels is expected to continue constantly, and natural gas, in particular, is expected to increase in the future owing to its lower CO_2 emission. However, even if the transition to renewable energy is becoming inevitable, reaching net zero will be virtually impossible without carbon capture, utilization, and storage due to some CO_2 released from the industries and households. Accordingly, in parallel with the transition, the technological development and social implementation for carbon dioxide capture and storage (CCS) to separate and/or collect CO_2 and store it underground are required, and carbon dioxide capture and utilization (CCU) to convert CO_2 into plastics and fuels, etc., are needed.

In order to establish a strong and stable supply-demand structure as described above, various types of infrastructures are required. Such infrastructures require highly secure, highly reliable structural materials that must satisfy various properties, such as strength, toughness, fatigue resistance, weldability, and corrosion resistance, at high levels in their service environments. For example, steel for liquefied-hydrogen tanks for transporting and storing hydrogen needs to have hydrogen embrittlement resistance in a wide range of temperatures, in addition to the toughness at cryogenic temperatures (−253°C). Materials for pipes used in natural gas reforming plants that produce hydrogen must be highly corrosion resistant to prevent welds from cracking due to stress corrosion. CO_2 injection pipes used in CCS need to have high strength and excellent corrosion resistance.

Nippon Steel Corporation announced its "Carbon Neutral Vision 2050" as its original scheme toward carbon neutrality. In the scheme, we determined to develop steelmaking processes that produce less CO_2 and contribute to realizing the carbon neutral society by offering the aforementioned infrastructure materials that support the realization of the carbon neutral society. This special issue introduces such steel materials that the Nippon Steel group has developed and introduces the reinforcement infrastructure for offshore wind farms, the geothermal power generation equipment, and the natural gas turbine system from the viewpoint of engineering. We have also been researching and developing fundamental analysis technologies that support such technological development on our own as introduced in this special issue. The entire Nippon Steel group has determined to promote various tasks through these material and technological developments so that we can contribute to the realization of the carbon neutral society. I would appreciate your instructions and support.