1. Overview of the Japanese Iron and Steel Industry

For the influences of the Great East Japan Earthquake happened in 2011, steel industry had been struggling with the problems during 2012. The major problem was about destroyed equipment and utilities in the works located in damaged area, which were handed well and fully recovered in the following year. Another problem was led by the regulation for the use of electricity and raise in its rates brought by nuclear disaster; they both had a big impact on steel works, especially on electronic furnaces.

Trends in the prices of iron ore, metallurgical coal, and other raw materials and fuels remained unstable, as in recent years, and steel demand was sluggish, dragged down by the fiscal crisis in Europe, slowing growth in China, and excess appreciation of the yen, which continued until the autumn of 2012. Against this backdrop, new companies such as Nippon Steel & Sumitomo Metal Corporation and Nisshin Steel Holdings were launched, and moves to restructure the iron and steel industry progressed, including the steel distribution processing industry, steel-related trading companies, and others.

1.1. Trends in Raw Materials for Iron and Steel

Since 2004, the supply-and-demand situation for iron ore, metallurgical coal, and other raw materials for iron and steel had been tight due to increasing demand in China, and raw material prices rose sharply. Recently, however, the growth of the Chinese market has slowed, and supply-and-demand conditions have changed. Looking at the trends in the Chinese market, there have also been moves by iron ore suppliers to review their scheduled expansion plans and capital investment in iron ore production equipment. The price of iron ore (Australia, fine ore) had been around $25/ton in 2004 before prices rose, but reached a peak of approximately $170/ton in the first half of 2011. This showed a declining tendency from 2011 through 2012, and had decreased to the $100/ton level at the end of 2012. A similar tendency could be seen in metallurgical coal (Australia, strongly caking coal), which spiked to about $320/ton at one time, and then fell to the level of approximately $170/ton at the end of 2012.

1.2. Trends in Steel-consuming Industries

An outline of the trends in steel-consuming industries in 2012 is presented below, based on the quarterly steel supply-and-demand report of the Japanese Iron and Steel Federation, etc.

In the construction-related civil engineering field, spending for public works had shown annual declines in recent years, but this turned to an increasing tendency, as the Japanese government committed approximately ¥3.3 trillion to earthquake disaster reconstruction in its supplementary budget for fiscal year 2011 and original budget for FY 2012. In the building construction field, there was a tone of gradual recovery, supported by demand associated with reconstruction as well as various types of housing measures.

The automobile industry enjoyed a high growth rate during the first half of 2012 as a result of subsidies for purchases of eco-cars, and new car sales (including imports) in calendar year 2012 exceeded 5 million units for the first time in 4 years, reaching 5.37 million, for an increase of 27.5% over 2011. Production of 4-wheeled vehicles also increased by 18.4% from 2011, reaching 9.94 million units.1)

In the machinery industry, external demand in the industrial machinery field slowed rapidly in the second half of 2012 due to the economic downturns in Europe and China, and as a result, both construction machinery and machine tools fell below the levels of the previous year.

Electrical machinery was also affected by stagnation in external demand. In particular, the production index for electronics suffered a large decline due to the end of the Eco-point system and intensifying international competition. In shipbuilding, the new order situation remained difficult, and a decrease of approximately 20% from the previous year was forecast in the volume of new keels.

1.3. Globalization of Japanese Steel Industry

During 2012, number of news was reported in regard to the overseas operation of Japanese steel companies. Nippon Steel & Sumitomo Metal Corporation announced a joint venture with the Australian company BlueScope Steel for an overseas company producing sheets for building materials, targeting the Southeast Asian and North American markets (former Nippon Steel; in August), an agreement to acquire the production facilities of WSP Houston OCTG Inc. (in October), a merger of secondary steel bar processing companies in Thailand (in October), and development of automotive tube businesses in Mexico and India (former Nippon Steel; in August and in February).

JFE Steel Corporation also announced several news, such as the start of a feasibility study for a integrated steel works with a blast furnace in Vietnam (in March), supply of manufacturing technology for automotive steel sheets and non-oriented electrical steel sheets to JSW Steel in India (in August and in December), and capital participation in Sahaviriya Steel Industries Public Co. in Thailand and an increase its stake in the existing JV Thai Cold Rolled Steel Sheet Public Co. in cooperation with Marubeni-Itochu Steel Inc. (in October).

Other Japanese steel companies announced their planes such as establishment of secondary processing base for wire rod material in China by Kobe Steel, Ltd. in January, devel-
development of an integrated steel mill with an electric furnace in Vietnam by Kyoei Steel Ltd. in April and establishment of a manufacturing base for automobile steel tubes in Mexico by Maruichi Steel Tube Ltd. in January.

To add some information, iron and steel traders increased their investment overseas, and steel service bases were expanded and improved in India, Indonesia, and Mexico.

1.4. Crude Steel Production
Under the conditions described above, crude steel production in Japan during calendar year 2012 decreased slightly from 2011, to 107.23 million tons, but remained above the 100 million ton level for the third consecutive year since the Lehman’s Shock of 2008. By furnace type, the annual total comprised 82.31 million tons of converter steel and 24.93 million tons of electric furnace steel. Converter steel decreased by 430,000 tons, and electric furnace steel increased by 80,000 tons from the previous year (Fig. 1).\(^2\)

World crude steel production in 2012 was 1,547.8 million tons, for an increase of 1.2%.\(^3\) Although crude steel production continues to show a rising trend, which exceeded 1,500 million tons for the first time in 2011, the rate of growth from the previous year slowed in 2012. As shown in Table 1, the top ten countries in crude steel production in 2012 include China, Japan, the United States, and so on. China’s growth rate from the previous year was 3.1%, but the growth rates in Germany, Brazil, and the Ukraine decreased by several percent.

The operating rate in the world steel industry at the end of 2012 was 73.2%,\(^3\) and a declining tendency continued from 2011. In particular, excess production capacity in China was remarkable, and this has become a factor in the declining profitability of Chinese steel companies.

The Japan Iron and Steel Federation published a forecast of domestic steel demand for FY 2013. It predicted crude steel production would fall slightly below the level of the previous year. It was figured out considering these factors; an increase of domestic steel demand in the construction field caused by recovery of capital investment and a rush of demand before an increase in consumption tax, failure to make strong recovery in manufacturing industries, which was caused by reduction of steel demand in shipbuilding and the tide of the transfer of production offshore in the automobile industry etc., and the unclear overview of overseas demand.\(^4\)

The following presents a review of iron and steel production technology in 2012.

2. Technology and Equipment

2.1. Technical Environment of Japanese Steel Industry
Amid global economic stagnation, in 2012, Japan’s crude steel production was limited to slightly over 100 million tons, which was roughly the same as in 2011. Having been raised sharply in recent years, the price of raw materials for iron and steel showed a declining tendency due to changes in the balance of supply and demand. They have been becoming difficult to purchase substantially by “resource nationalism”.

As for overseas expansion, Japanese steel companies succeed at the movement of overseas development by steel-demanding industries like automobile and home appliances manufactures, although their demand is varied depending on each field.

Concerning the energy issue, the price of electricity raised by the disaster of nuclear power plant became a big problem in the steel industry.

As a large-scale National Project in the field of iron and steel technology, the COURSE50 (CO2 Ultimate Reduction in Steelmaking Process by Innovative Technology for Cool Earth 50) project, which aims to achieve a radical reduction in CO2, completed its 5-year as the 1st step that allowed to proceed to the 2nd step. Beginning in FY 2013, Japan began study of technology development in connection with a new National Project, “Development of New Structural Systems Using Innovative New Structural Materials.”

2.2. Iron-making
Pig iron production in 2012 was 81.41 million tons, which was an increase of 0.5% in comparison with the 81.03 million tons of 2011.\(^5\) Blast furnace productivity decreased to 1.88 t/m\(^3\)-d from 1.91 t/m\(^3\)-d in FY 2011.

The number of operating blast furnaces at the end of 2012 was 27. It increased from 26 at the end of 2011. Keeping the situation at the end of 2011, 13 blast furnaces with inner volumes of more than 5,000 m\(^3\) were in operation at the end of 2012.

Nippon Steel & Sumitomo Metal (former Nippon Steel)
began relining of Kimitsu Works No. 2 BF following a 3rd campaign of approximately 17 years, and the blast furnace was blown-in again in May 2012. In this project, the inner volume of the blast furnace was expanded from 3 273 m³ to 4 500 m³, and the furnace top charging system was changed to a parallel hopper type. The number of tap holes was also increased from 2 to 4, and No. 2 BF was reborn as a blast furnace with excellent operational stability and cost competitiveness.

At JFE Steel West Japan Works (Fukuyama District), cumulative amount of pig iron tapping exceeded 400 million tons in May 2012. This was achieved in 45 years and 9 months after the first blast furnace was put into operation at Fukuyama in August 1966 and is the first time that a single steel works in Japan has reached the 400 million ton level.

2.3. Steelmaking and Iron Powder
Crude steel production in calendar year 2012 was 107.23 million tons, which was a decrease of 0.3% from the 107.60 tons in 2011 (Fig. 1).

The continuous casting ratio is shown in Fig. 2. The ratio maintained a high level of 99.9% for ordinary steel and also increased to 96.6% for special steel.

In November 2012, Kobe Steel Kobe Works started up a ladle type de-Si and de-S station in the hot metal pretreatment process that optimizes the functional division of desiliconization, dephosphorization, and desulfurization before converter refining in order to improve cost competitiveness. Iron yield is improved by reducing slag generation in the steelmaking stage, achieving a cost reduction of ¥1 billion per annum.

At JFE Steel East Japan Works (Chiba District), a feeding technology for ore heated by a burner in the chromium ore smelting reduction furnace for stainless steelmaking. This technology enhances energy efficiency by enabling addition of chromium ore in the furnace while performing heating with the high temperature flame of a pure oxygen burner.

At JFE Steel East Japan Works (Keihin District), a process control technology utilizing an operation database for the steelmaking process was developed. A technology in which new models are constructed each time operation is performed based on operational data accumulated in the database was applied to modeling of the de-S and de-P processes, and a reduction in composition variations was achieved by optimizing the input amounts of submaterials and oxygen. This technology was then applied at all of JFE Steel’s other works.

Sanyo Special Steel Co., Ltd. installed a new 60 ton continuous casting machine at its No. 1 Steelmaking Shop, which previously had only ingot casting equipment. The new continuous caster is the same large-section vertical type as that at the existing No. 2 Steelmaking Shop and enables production of high quality special steel.

In the iron powder field, JFE Steel East Japan Works (Chiba District) reinforced the capacity of its sponge iron fine-crushing plant. In order to respond to increased demand for powder metallurgy, which is used in automotive parts, and the new demand fields of agriculture and the environment, Chiba District increased the number of sponge iron grinders at the Iron Powder Plant from 3 to 4, thereby increasing its reduced iron powder production capacity from 2 700 tons to 3 000 t/month, or a 22% increase.

2.4. Sheets, Plates, and Pipes
2.4.1. Sheets
In February 2012, Nippon Steel & Sumikin Stainless Steel Corporation shut down 3 existing coil buildup lines at the cold strip mill in Hikari Works and consolidated production on one newly-installed line. The mechanical parts of the former lines were partly revamped and applied to other uses, and a disk laser welding machine, an efficient plant layout, and automation equipment were introduced at the new line. As a result, the new line achieved a large improvement in productivity to more than 2 times the former level, as well as high efficiency in in-house material handling and improved product quality.

2.4.2. Plates
Nippon Steel & Sumitomo Metal Corporation (former Sumitomo Metal Industries, Ltd.) introduced a 7 000 ton leveler, which is the world’s largest, at its Kashima Works Plate Mill, which completed a series of equipment investments aimed at achieving high-end production and differentiation. During FY 2012, the plant’s capacity was increased by approximately 10% from the previous year, and a further expansion of sales was promoted, making full use of the new equipment.

Kobe Steel completed expansion of the heat treatment furnace at the Kakogawa Works Plate Mill and began commercial operation in January 2013. By reinforcing its heat treatment capacity, the company is promoting sales expansion in the energy field, where steady demand is expected, with the aims of increasing its presence in the market and improving profitability.

2.4.3. Steel Pipes
Three companies, Nippon Steel & Sumitomo Metal Corporation, Sumitomo Pipe & Tube Corporation, and Nippon Steel & Sumikin Plant Co., Ltd., jointly developed a mass-production processing technology called 3-Dimensional Hot Bending & Quench (3DQ) which enables production of ultra-high-end steel tube members with complex shapes without use of dies.

JFE Steel Corporation developed a nondestructive inspection technology for electro-resistance-welded (ERW) tubes, which was introduced at the company’s East Japan
Works (Keihin Area) and Chita Works at East Japan Works (Keihin Area), this technology was applied at the 24-inch Large-diameter ERW Pipe Mill. Real-time flaw detection of the full length of the weld seam by on-line phased array ultrasonic testing is performed, enabling nondestructive inspection for extremely small defects. This contributes to quality assurance of ERW pipes with excellent low temperature toughness.

2.5. Measurement, Systems, and Analysis

JFE Steel Corporation developed an automatic control technique for online processes using a local regression model and applied this technology to a commercial desulfurization process control system. Models are constructed each time operation is performed based on operational results accumulated in a database, and applying the model to a desulfurization and a dephosphorization process, variations in chemical composition of steel are reduced by optimizing inputs of submaterials and oxygen.

JFE Steel Corporation also developed a production planning system for the heat treatment equipment at the East Japan Works (Keihin Area) Plate Mill. Improved production efficiency and optimization of the margin in delivery schedules were realized simultaneously by combining concentrated processing of production lots for which adjustment of the delivery margin is possible and processing to determine the heat treatment lot sequence that maximizes production efficiency, together with construction of a system for mutually-coordinated preparation of the production schedules of two heat treatment furnaces.

In 2006, Toyo Kohan Co., Ltd. and Ayaha Engineering Co., Ltd. began joint development of a dedicated surface inspection device for various types of automotive steel sheets such as coated steel sheets, cold-rolled steel sheets. In 2011, this technology was commercialized under the trade name i-TOP.

JFE Steel Corporation developed a “Product Distribution Planning System” for integrated planning and management of deliveries of products to customers from multiple steel works and distribution centers, which achieves both enhanced efficiency in logistics and reduced CO2 emissions.

2.6. Environment and Energy

2.6.1. Government Efforts

The 18th session of the Conference of the Parties to the UNFCCC (COP18) and the 8th session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (CMP8) were held in Doha, Qatar from November 26 to December 8, 2012.7)

For the result of discussions in a high-level segment, a series of COP and CMP decisions were adopted as the “Doha Climate Gateway,” which was accomplished after working level negotiations in the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP), the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP), the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA), and the sessions of two Subsidiary Bodies. AWG-KP and AWG-LCA agreed to prepare for negotiations in the ADP beginning in 2013. As a result, the conference sent a message to the world that “basic arrangements on negotiations have been set up toward an agreement by 2015 on a new legal framework for 2020 and onwards”.7)

2.6.2. Efforts of Japanese Steel Industry

The Japan Iron and Steel Federation has established a “Voluntary Action Programme for the Iron and Steel Industry” and is promoting efforts with the following contents.8)

1) Conserve energy with more efficient steel production processes

(1) Assuming annual crude steel production of about 100 million tons, the goal is to achieve a 10% reduction in energy consumption used by steel production processes by fiscal 2010 compared with fiscal 1990, the reference year (A 10% cut in energy consumption is viewed as equivalent to a 9% cut in CO2 emissions).

(2) However, even if crude steel output exceeds 100 million tons, the steel industry is determined to do what is needed, including use of the Kyoto Protocol mechanisms, to reach this target.

(3) The 10% reduction is to be achieved based on average energy consumption for the five-year period ending in fiscal 2012.

2) Contribute to energy conservation outside the steel industry

(1) Reuse one million tons of waste plastics and other materials, assuming that the required collection system can be established.

(2) Use steel products and byproducts to contribute to energy conservation.

(3) Use international technical cooperation to contribute to energy conservation.

(4) Utilize unused energy at steel mills in neighboring areas.

(5) Increase activities involving consumers, businesses and transportation.

3) Development of revolutionary technologies

(1) Technology to separate CO2 from blast furnace gas for recovery.

(2) Iron ore reduction technology using modified hydrogen from coke oven gas.

As actual results of the above-mentioned Voluntary Action Programme for FY 2011 (participated by 90 companies), crude steel production was 102.38 million tons, for a decrease of 2.2% from FY 1990, and as a result of positive promotion energy saving measures, energy consumption in FY 2011 was 2212PJ, for a decrease of 9.3% against FY 1990. Energy-originated CO2 emissions during FY 2011 were 183.7 million t-CO2, for a reduction of 8.5% from FY 1990.8)

The Japan Iron and Steel Federation has also laid out the basic direction for the Japanese steel industry as follows: “The Japanese steel industry will endeavor to further improve its energy efficiency, which is currently on the world’s highest level. With Japan continuing to serve as a base for production and development, the industry will present to the world eco-processes, eco-products, and eco-solutions, while strengthening industrial cooperation with manufacturing industries, and thereby will contribute to the growth of the Japanese economy and creation of employment, while also grappling with measures for controlling global warming.”
In this, it is estimated that eco-products contributed to an emission reduction of 22.08 million t-CO₂ in FY 2011 in the stage of use as final products. ⁸)

It is also estimated that eco-solutions contributed approximately 43.0 million t-CO₂ in reductions at the global scale in FY 2011 through transfer and dissemination of the world's most advanced energy saving technologies, centering on the developing countries. ⁹)

The aimed direction of COURSE50 (CO₂ Ultimate Reduction in Steelmaking Process by Innovative Technology for Cool Earth 50) targets a reduction of approximately 30% in CO₂ emissions in production processes by reduction of iron ore by hydrogen and separation and collection of CO₂ from blast furnace gas. The goals of this project are to realize the first unit of a commercial process by 2030, preconditioned on creation of the infrastructure for CO₂ storage and securing the economic rationality of the commercial process, and dissemination by around 2050, based on the timing of replacement of blast furnace-related facilities. Regarding the ore reduction technology using hydrogen, experiments at the test blast furnace of the Swedish company LKAB were proposed, and reduction in the amount of emitted CO₂ was confirmed in tests involving tuyere injection and shaft blowing of hydrogen in test operation carried out in April-May 2012. As a production technology for the hydrogen used in the above-mentioned technology, efforts are being made to develop a technology which amplifies the hydrogen fraction in coke oven gas (COG) by thermal decomposition of the tar in COG, and tests with a bench plant-scale catalytic reactor at a scale of approximately 30 Nm³/h using actual COG confirmed a two-fold increase in the hydrogen amplification rate. ⁸)

In November 2011, JFE Steel began full-scale operation of a test production plant for a new blast furnace feed material called “Ferro-coke” at its East Japan Works (Keihin District). This technology is being developed jointly by four integrated steel makers, etc. as part of the project “Development of Innovative Steelmaking Process for Strengthening Resource Response Capabilities” sponsored by Japan’s Ministry of Economy, Trade and Industry (METI). The test production plant is a 30 tons/day plant comprising mixing and forming equipment for low grade coal and iron ore and a shaft-type drying furnace. Together with establishing the forming and drying technologies, full-scale long-term operating tests were begun in 2012. Assuming substitution of Ferro-coke for about 30% of the coke now used in the blast furnace, a reduction of approximately 10% in energy inputs to the ironmaking process, an increase in the use ratio of low grade raw materials, and a CO₂ emission reduction effect are expected.

In September 2012, Nippon Steel & Sumikin Stainless Steel introduced equipment at Hikari Works which recovers rare metals such as chrome, nickel, from dust, scale, and other byproducts of the stainless steelmaking process. This equipment was installed at the existing RHF process with partial financial support by the METI program “Assistance of Facilities Introduction for Industries Using Rare Earth Elements.” Recycling of substantially 100% of byproducts enabled an expansion in the amount of rare metal recycling of more than 1 000 tons/year.

3. Technology Trade and Development

3.1. Technology Trade

Figure 3 shows the balance of technology trade up to FY 2011. ⁹) The amount of compensation for technology exports increased 16% from the previous year, while payments for technology imports decreased by 10%.

3.2. Research Expenditures and Number of Researchers

The following three items were arranged using data published in Companies, etc. in Table 1 of the “Statistical Survey of Researches in Japan” by the Statistics Bureau of the Ministry of Internal Affairs and Communications.

The results are shown in Figs. 4–6. ⁹)

3.2.1. Ratio of Research Expenditures to Sales

The ratio of research expenditures increased from the previous year, to 69%.

3.2.2. Number of Regular Researchers per 10 000 Employees

In all industries, this index continued to show a steadily
increasing trend. Although the trend was also similar in the steel industry, the rate of increase was lower. The total number of regular researchers in the steel industry was approximately 4,500 persons, representing a decrease to the level in 2009.

3.2.3. Research Expenditures per Regular Researcher
In all industries, there was a slight increasing tendency in 2012. In particular, in the steel industry, this index basically returned to the level in FY 2008 before the Lehman’s Shock.

3.3. Trends in Research and Development Utilizing Public Funds

In the case of i) COURSE50, step 1 of Phase 1 was completed in 2012, and the project is scheduled to continue under step 2 (FY 2013–2017).

A main project which began in FY 2012 was “Elements strategy initiative for structural materials (research center formation type)” (FY 2012–2022; budget for FY 2012: ¥150 million) of the Ministry of Education, Culture, Sports, Science and Technology (MEXT).

The main continuing projects were i) “Hetero-structure-controlled metal materials project” (FY 2010–2019), ii) “Technology development project of advanced USC (A-USC) thermal power generation” (FY 2008–2016), etc.

The main projects on iron and steel-related research and technical development topics being carried with public funds are shown in Table 2. Many of these topics are in the fields of processes, the environment and energy, and materials development.

4. Development of Human Resources in Technical Fields
The Iron and Steel Institute of Japan (ISIJ) has conducted a variety of training projects to date (Iron and Steel Engineering Seminars, Iron and Steel Engineering Seminar special courses, Advanced Iron and Steel Seminar, Student Iron and Steel Seminar) for cross-industry core human resources development. In FY 2012, as in FY 2011, the main focus of ISIJ training projects was the project to strengthen basic education, as the ISIJ continued the “Introduction to Iron and Steel Engineering” seminar for graduate students for master’s degree and the “Experiential Seminar on Advanced Iron and Steel” for undergraduates.

“Introduction to Iron and Steel Engineering” was a 4-day seminar featuring lectures on the fundamentals of iron and steel engineering and technical development at the site by teachers from the university and company sides, as well as a plant tour on the final day (in FY 2012, at JFE Steel East Japan Works (Chiba District)). This year, 32 students from 12 universities participated.

The “Experiential Seminar on Advanced Iron and Steel” was a 1-day course consisting of an introduction to advanced technologies related to iron and steel and the future outlook, and a plant tour. Seminars were held at Nippon Steel & Sumitomo Metal Muroran Works, Kashima Works, and Hirohata Works and JFE Steel West Japan Works (Kurashiki District). These seminars were also open to students in non-materials-related fields, and attracted a total of 50 participants.

The program “University Special Lectures by Top Management,” which began in FY 2011, was also continued in FY 2012. This is a series of lectures by members of the top management of steel companies and is conducted the stimulate interest in industry by communicating the attractions of the iron and steel industry, as manufacturing industry. The lectures this year were held at the same universities as in FY 2011 (Japan’s 9 National Universities including Tokyo Institute of Technology and Yokohama National University, and Waseda University) and attracted a total of approximately 1,300 students.

As in the previous year, all of these seminars and lectures were very well-received and are scheduled to be continued in the coming years.

5. Technology Study in the ISIJ
5.1. Technical Committees
The Technical Committees, which promote activities particular to the ISIJ, hold Committee Meetings periodically to study and discuss important issues at the present point in time. During FY 2012, the Technical Committees held 34 Committee Meetings (17 Spring Meetings, 17 Fall Meetings), which was approximately the same as in FY 2011.
Total participation was 2,767 persons (FY 2011: 2,745), including 55 university researchers and others, which was similar to FY 2011 (61 persons).

Industry-academic collaboration with the Academic Divisions is firmly established in the Technical Committees, which encourage exchanges such as participation of university researchers in Technical Committee Meetings, and joint planning with the Academic Division.

Technical Subcommittees study designated technical issues as common priority topics. In FY 2012, 19 Technical Subcommittees were active. Six topics were completed, such as “Rolling Oil Removal Process (Surface Treated Steel Sheet Committee),” and 9 new topics, such as “Environmental Dust Collection Process Technology for Steelmaking Process” (Steelmaking Committee), were begun.

In addition to lecture meetings for young engineers and plant tours/lecture meetings with other industries, which continued from previous years, plans aimed at further activation of Technical Committees were implemented, including a survey of overseas technologies, plant tours, etc.

5.2. Interdisciplinary Technical Committees

Interdisciplinary Technical Committees study cross-field and inter-industry technical issues in activities with a period...
of within 3 years.

In FY 2012, a new Interdisciplinary Technical Committee on “Technologies for improvement of reliability of practical structural steels” began activities.

In the Interdisciplinary Technical Committee on “Desirable steel materials for automobiles,” 4th Phase activities, which began in FY 2010, reached their final year, and during FY 2012, the group studied future directions and summarized the work of the 3rd Phase WG on Surface Hardening Treatment and WG on Low Cost Welding Technology for Special Steels.

Three working groups of the Interdisciplinary Technical Committee on “Pressure Vessel Material Technologies,” the WG on Study of Material Standards, WG on Evaluation of Hydrogen Embrittlement of Steel Materials for Chemical Plants, and the WG on High Chromium Steels, carried out respective activities including survey research and experiments.

5.3. Research Grants and Research Groups

In “Grants for Promotion of Iron and Steel Research,” 41 new projects were selected as grant recipients (including 19 by young researchers). Combined with the 36 projects selected in FY 2011, this program will support a total of 77 projects in FY 2013.

During FY 2012, 27 Research Groups were active, of which 12 were terminated in March 2013. Eight new Research Groups began activities in FY 2012.

REFERENCES