
Abstract

Emerging Materials and Development Strategies in the 4th Industrial Revolution

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In recent years, the hottest issue in the global economy and industry is the fourth industrial revolution. The new industrial revolution, which means a digital transformation through a link of physical cyber system and virtual reality, fundamentally changes production and consumption activities and creates innovative types of products and services. Under these situation, intelligent information technology is the foundation of the new industrial revolution. Intelligent information technologies, including Artificial Intelligence(AI), which is well known as the leading technology representing the 4th industrial revolution, the Internet of Things(IoT), cloud, big data and high-speed network, are key factors driving the convergence of manufacturing and services, and the smartization and servicification. As a result, most of the recent

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major national R&D projects related to the Fourth Industrial Revolution have focused on the development and application of intelligent information technology.

On the other hand, interest in materials, which is another factor that determines the competitiveness of industries and products in the era of the fourth industrial revolution, is relatively low. To realize universal technologies that will lead the fourth industrial revolution such as Internet of Things(IoT), cloud, and big data, advanced components such as intelligent semiconductors and smart sensors are indispensable. In order to upgrade these parts, it is essential to secure advanced materials. In addition, the development of advanced materials is also essential for new emerging products to the fourth industrial revolution such as unmanned vehicles, smart factories, robots, smart devices, and energy must also be advanced.

From the material industry perspective, the flow of the fourth industrial revolution can provide us with new opportunities. Intelligent information technology that drives the fourth industrial revolution can also drive innovation both in the demand and supply side of the material industry, in other words, in the path of demand-creation and technology-push.

The changes in the external environment, such as manufacturing Re-lease Promotion Policy from the US, Germany, and Japan, and China's Manufacturing Power Rise have led to a new goal of our manufacturing industry. Our manufacturing strategy focusing on advanced production technology needs to change to a new industrial strategy based on an ecological point of view. This means that new goals and vision for the field of materials should be set up.

The new material industry policy needs to be shifted to focus on enhancing the value added of the entire industrial ecosystem to advance the manufacturing industry.

Strengthening the competitiveness of the materials industry can provide a chance for our key industries to get out of the Nut Cracker position and secure a new position. In addition, the new trend of the Fourth Industrial Revolution can serve as a catalyst for this. In other words, it is necessary to establish a strategy to foster the material industry in order to secure competitiveness of the industrial ecosystem. Above all, it should be promoted to transform the material industry ecosystem into the innovation-led industrial structure through the strategy of accelerating commercialization centered on materials demand companies, and building intelligence information and SW infrastructure.

Considering our ability to cope with emerging promising high-tech materials in the era of the 4th industrial revolution and the current problems of our material industry, strategies for developing and fostering promising materials industry can be reduced to the following four. First, the problem of under-investment should be solved. This means that we need a different approach from our manufacturing industry fostering method, which has achieved industrial growth through economies of scale so far. In the constraints of limited national goods, R & D investment strategies for materials with high uncertainties, such as high-tech materials, are an indispensable condition for solving the under-investment problem. This includes sharing roles between government and private R & D investment and improving the structure of government R & D investment. Second, it is essential to increase the

low efficiency of government R & D investment. From a point of view that the performance is spreading to the national economy through the commercialization and industrialization after the R & D investment, strategies to promote commercialization are important issues to be solved. Third, it is necessary to solve the polarization of innovation capability. Although this is not limited to the material industry, strategic investment and policy in the field of high-tech materials can solve the polarization of innovation capacity. Strategies are needed to bridge the gap of innovation capacity between the metropolitan area and the region and between large corporations and SMEs. Lastly, it is necessary to build the Intelligence information technology infrastructure as a strategy for meeting the trend of the 4th Industrial Revolution and building an innovation-driven ecosystem. Strategies are needed to expand the range of manufacturing value chains by decreasing the existing hardware-based infrastructure and strengthening the manufacturing service capabilities of the material industry ecosystem based on intelligence information technology.