The Materials Genome Initiative and Advanced Materials

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Material is the basis for manufacturing. Materials innovation has always been the core of disruptive technical revolution. However, it takes 15–20 years or more to place a material on the market after its initial discovery. Therefore, the traditional scientific methods of intuition and trial and error cannot keep up with modern industry's rapidly increasing need for new materials. It is now common for innovation in materials research and development methods to accelerate the process from discovery to the application of new materials.

In 2011, US President Barack Obama announced the Materials Genome Initiative (MGI) and clearly stated that the goal of the MGI is to discover, develop, manufacture, and deploy advanced materials at twice the speed and for a fraction of the cost of what is currently possible. The purpose of the MGI is to achieve global competitiveness in the 21st century.

The ultimate intent of the MGI is to usher in a new paradigm or culture of materials research and innovation in which materials design is conducted by up-front simulations and predictions, followed by key validation experiments. This process is in contrast to current practice, which is heavily based on experimental iterations and experiences.

The MGI could accelerate materials design and deployment by:

(1) Developing effective and reliable computational methods and software tools;

(2) Developing high-throughput experimental methodologies to validate theories and to provide reliable experimental data to the materials databases; and

(3) Establishing reliable and widely applicable databases and materials informatics tools.

Therefore, it is very important to built MGI infrastructure which is consisted with three platforms: computational tools, experimental tools, and digital data.

In China, core competitiveness in the field of new materials is rather weak. Our self-sufficiency rate of key materials is somewhat low. By considering how developed countries such as the United States have suddenly increased the pace of their materials research, we must decisively launch the Chinese version of the Materials Genome Initiative as a national strategy. Our purpose will be to achieve extraordinary speed in new materials development in order to meet the nation's great strategic demand as well as the requirements for the strategic transformation of China's manufacturing industry. The most important task in this new project is to construct several "materials genome centers" with three platforms: computational tools, experimental tools, and digital data. Simultaneously, several types of materials that are urgently needed by China should be selected for demonstration purposes. These may include: energy materials, composite materials, low-dimensional electron materials, inorganic functional materials, high-temperature alloys, and biomaterials. In this way, China will increase its competitiveness in the field of advanced materials, and encourage new growth in its manufacturing industry.

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