The Application of Experimental Research Centers and Research Oriented Model to Specialty Materials Experimental Teaching

Xuming Zhang¹, Dengyu Gai, Zhongyi Niu, Yunpeng Chang, Minghui Ding, Legan Hou

Abstract

Experimental research center and research oriented model, is to test basic skills and the application of technology as the main line, to cultivate students' comprehensive experimental skills, to add professional and technical capacity and integrated design experiment teaching practice session, and introduce scientific research and experimental teaching, training students to scientific thinking to teaching model which analyze and solve problems. This mode has positive and stimulating effect on comprehensive quality and innovative ability for students using modern science and technology to solve practical engineering problems. This paper discusses the research status and the innovative application of materials science experiments and teaching professional research-oriented, and proposes an effective way to improve this kind of new model.

Keywords: Materials science; Experimental teaching; Innovative applications

1. Introduction

The 21st century is a knowledge-based economy accounts for international economic dominance era. 21st Century education is education for the knowledge economy. Experiment and Research Center oriented model is very aptly strong practical design experiment teaching and comprehensive practical and theoretical aspects of strong research-oriented closely together which help train students scientific thinking, the use of knowledge to analyze and solve problems. The experimental teaching is an important part of college teaching system, plays an irreplaceable role in cultivating students' innovative spirit and practical ability also.

2. Research Status: Specialty Materials is an applied science and engineering professionals. Material industry is an important basic industry of our country, as a practice-based discipline, materials science and engineering are inseparable. Therefore, materials science graduates mostly for scientific research and production line, mainly engaged in new materials, new technologies, development of materials engineering and theoretical research of new technology, is the main force of the future in the field of technological development. Innovation is the future of high-quality scientific and technological personnel should have the basic ability to develop this ability should be run through the entire teaching process.

¹College of Materials Science and Chemical Engineering. Harbin Engineering University. Heilongjiang Province. 150001. China
Laboratory plays an important role in the development of science and technology, as opposed to theoretical teaching, experimental teaching intuitive, practical, comprehensive and innovative, more conducive to cultivating students' innovative ability. In today's highly developed science and technology, materials science, as students must have basic knowledge of wide caliber of material, but also must have modern equipment operating skills and ability to innovate, is good at creative way to successfully learn the basics of material science and technology into and social productivity. Traditional specialty materials science experiment teaching mode, set up the experiment is based on the content of the curriculum requirements often mechanical settings, ignoring the organic continuity of the pilot projects; experimental course assessment methods are too simple, mostly based on lab reports; experimental teaching staff a single, fixed, greatly affect students 'experiment interest and initiative, not conducive to improving the quality of experimental teaching, is not conducive to students' creative ability. This old experiment teaching model has apparently does not apply to materials science professional in the 21st century integrated Applied Innovative Talents. In order to meet the needs of modern social development, it is necessary to reform the old experimental teaching mode, to establish a new training model complex innovative talent. After years of materials science curriculum teaching process, members of the teaching and research summary of teaching experience, proposed "scientific research and experimental center-oriented model" teaching philosophy, established a research-oriented combination of materials science experiment teaching new professional model.

3. Experimental Center Innovation in Experimental Teaching

Objective Materials Analysis Course experiment is to make students understand the x-ray powder diffraction (XRD), electron microscopy (SEM, TEM) and other materials teaching often use modern analytical instruments equipment principle, application methods, applicable range of conditions and material research applications, the ability of students to solve problems. If the student to fully understand and learn detailed analysis equipment for each principle, construction, testing methods and applications notes, class limited "material points" classroom teaching experiment is not enough. To solve this problem, we can usually open before the start of the experiment or laboratory, with the intention to accept students to the lab field trips, students are encouraged to join the teaching or research team conducted preliminary training. Students use the lab open opportunity to separate the laboratory teacher or graduate studies related to the use of techniques and instruments based on the operational details of the experiment, understand the general direction of scientific research and content group, so as to more quickly into the role of scientific research, master experimental skills fully prepared, but also better able to develop students' sense of team, scientific thinking and innovative spirit and so on.

4. Research-oriented model in Experimental Teaching

Research-oriented reform of the teaching system theory to promote the reform of experimental teaching system, research-oriented teaching and experimental teaching reasonable convergence with the development of the situation in education, basic knowledge
of materials science and theoretical concepts have become increasingly demanding, requiring master content increasing, while the allocated hours are less and less. To solve this problem, we can be professional basic course for system integration, according to the curriculum system frame of mind "module" and "Network," a combination of construction, which merge with each other duplicate content, retaining its independent content, increase reflects frontier of knowledge, curriculum content re-divided, the "research-oriented" and "engineering practice," combine to form the necessary knowledge contained materials science, can reflect the experimental teaching of modern materials science a new system, and the material science Teaching achieve "one step starting point." Theoretical results of the reform of the education system have become an important basis for experimental teaching system reform, and promote the reform and improve the experimental teaching system. New Experimental Teaching System has stressed the independence of the experimental program, the experimental curriculum freed from subordination corresponding theoretical courses, the implementation of independent course; the other hand, the modular architecture of the course, the theoretical teaching and experimental research teaching reasonable convergence with and complements each other. Using this new model of research-oriented a significant effect that: (1) changed the traditional indoctrination teaching model and the lack of innovative verification experiments, led to strong student interest in learning to play the students' initiative, culture customary sense of innovation and independent thinking of students. (2) By designing experiments and test preparation materials, detailed written records of experiments to improve the students' practical ability and the ability to operate equipment, train the students summarize the summary and written communication skills. (3) Train students of good quality research and develop team spirit seriously, seeking scientific attitude, and improve students' ability to analyze and solve problems. (4) Train the students rigorous scientific thinking, so that students can enter the thesis and design, graduation practice, follow-up research study stage as soon as possible; also laid a solid foundation for students to pursue graduate studies and embark on social work.

5. Experiment and Research Center oriented model in Materials Science Experiment Teaching

The group’s members may attempt to adapt "material points" experimental teaching content of the course, update and reform the teacher research funds into the experimental teaching, the formation of a new organizational model experimental teaching and scientific research center combination, according to materials of Hours arrangements and the degree of difficulty of materials of teaching and research of science undergraduate teaching and research.

Experiments and research projects combination of "material points" experiment course content and time allocation of experimental teaching new organizational model, considering the unity and coherence of materials analysis methods. Experimental characterization of each material by means of a public organically integrated into a comprehensive analysis of experiments, between experimental and has a strong logic of mutual inspection, the results of previous experiments may be the next experimental evidence. Materials science experiment
content both cutting-edge content, but also the content of analytical chemistry, materials chemistry and combines the basic theory of knowledge, involved extensive technical, complex operation, emphasizing the comprehensive experimental, exploratory and continuity. This from isolated, unity of validation experiments to design, comprehensive, applied experimental changes, not only to achieve the training requirements for teaching students basic experimental skills, but also take the initiative to encourage students to think, to stimulate the students to learn professional basic knowledge and interest in exploration, research and passion to create. Practice has proved that: the establishment of experimental and research projects combining materials chemistry experiment teaching new model for the cultivation of passion students to learn and experiment, mobilize students enthusiasm and initiative to stimulate students 'research potential to improve students' practical ability, organization and coordination ability, problem-solving skills and to develop a comprehensive and innovative talents of all-round development has a very important role. We can take the following way to the research-oriented model to penetrate into Practice Teaching.

The specific method is the creation of new experimental teaching system, including the "basic experiment, comprehensive experiment design, engineering practice, experiment, engineering practical experiment" four experimental platforms, we will test four-level progressive, progressive form of integration organic whole, to achieve the purpose of "skills" and "smart training". ① "basic experiment platform" includes metal smelting and casting experiment, experiment materials plastic molding, metal material and heat treatment experiments, experimental feature film material preparation, preparation and sintering experiments powder materials, preparation and processing dilute your material testing, material physical performance test, mechanical properties of materials testing laboratory, experimental electrochemical analysis, metallurgical microstructure analysis of experimental inorganic material microstructure analysis experiment, electron microscopy experiments, X-ray diffraction experiments 15 experimental foundation courses, and corresponding theoretical courses dovetail with basic operations, basic skills students. ② "Comprehensive Design Experimental Platform" is a great big comprehensive materials science and engineering significance of the different experiments between courses. The experimental platform, from casting materials, molding materials processing, materials analysis, performance testing, cultivate students' ability to apply knowledge, comprehensive experimental design and analysis. ③ "Practical engineering experimental platform" The combination of materials science and engineering and production applications, focusing on materials science and engineering materials, practical engineering problems, deepening the materials science and engineering, materials engineering knowledge application, aimed at improving the students to solve practical engineering capacity issues, expanding the scope of knowledge. ④ "scientific research and innovative experimental platform" to scientific research and the introduction of advanced technology research and teaching, so that students have access to understand scientific methods to understand the experimental scientific research in the application, students have initial capacity of scientific research and innovation.
6. The New Application Ways to Improve Center experiment and scientific research-oriented model

In the experimental teaching process, cross feed information between teachers and students is a new direct and effective way to improve experimental teaching mode, but also experimental teaching activities is an important and indispensable part. Crossfeed establish a good system to improve teaching, improve teaching quality assurance. We have established crossfeed information including teaching methods, teaching content, teaching tools, teacher-student peer assessment, teacher-student emotional aspects. After each experiment, we can freely about some of the students, the students learn to grasp the degree of experimental content, experimental operation of proficiency, recognition of teaching methods, teaching attitudes of feedback information; or students can anonymously strip presented in the form of comments and recommendations. Students experiment content and operation of proficiency teacher is granted a content feedback. Teachers should be summarized according to the feedback of experience gained in order to improve the experimental teaching; at the same time, teachers must also exist for students in a timely manner problems to be corrected and consolidated, so that students understand what is right and what is wrong. Establish crossfeed system is conducive to teaching and learning. Through the above experimental teaching reform initiatives, materials students can be more extensively involved in the synthesis and study of the experiment, the experimental innovation ability and problem solving skills are significantly improved, while also teaching resources laboratory optimized and efficient use. to create an enabling innovative talents of high-quality educational environment is the ultimate goal of experiment teaching material reform, in order to achieve this goal, will continue to explore and practice new ways and means.

7. CONCLUSIONS

The laboratory and research-oriented model are leaded to Teaching materials science experiment, this reform initiatives the strong knowledge desire for students. Application of this new model enable students to successfully achieve the thesis requirements, and some students in the domestic or foreign material science journals, conference papers published relevant for them to establish a good role model and further studies classmates paving the way; even the students after graduation, has also been affirmed employer of all ages and various aspects of ability. I believe that through years of practice, and continuously improve and perfect the reform measures, experiments and research projects combination of “material points” experimental teaching will achieve better teaching effect, so that the overall quality of students receive comprehensive development and remarkable improve. In short, the new model of teaching and research projects can be combined to increase the diversity, practical and advanced experimental techniques of teaching, the cultivation of innovative talents comprehensive integrated development of the new century, plays a vital role.
References