Progress in Polymer: Curriculum Construction and Innovative Practice

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Abstract. Based on the specialty orientation of Polymer Materials and Engineering in Beijing Institute of Graphic Communication (BIGC), this paper proposed the specific purpose, significance and basic principle on the course construction of Progress in Polymer. The basic content of curriculum construction mainly contain the lecture material construction, classroom teaching, practice and examination forms. The overall goal of this course is to train students with an international perspective and suitable to the economic and social development demands.

Introduction

Beijing Institute of Graphic Communication (BIGC), which was founded in 1958, has developed into a comprehensive communication university characterized in printing and publishing, along with the coordinating discipline development in engineering, the liberal arts, management, art, and economics. However, compared with the international printing and packaging professional education, and even some advanced educational model in China, there are still many confusion and shortcoming in the education. For example, the professional development direction is not clear, the subject system is not systematic, put overmuch emphasis on elementary knowledge education and look down on practice skill training.

At present, with the rapid development of printing and packaging industry, large number of high-level individuals with innovation and professional skills in printing and packaging is urgent needed. Therefore, it is important to explore scientific and rational training model suitable for the development of printing and packaging industry\cite{1-2}. According to professional orientation and development plan on Polymer Materials and Engineering in BIGC, this paper proposed the specific purpose, significance and basic principle of the course construction on Progress in Polymer. The basic content of curriculum construction mainly contain the lecture material construction, classroom teaching, practice and examination forms.

Specialty Orientation of Polymer Materials and Engineering in BIGC

The major of Polymer Materials and Engineering in BIGC began to enroll student from 2006. It has become to an indispensable major in BIGC\cite{3}. Based on the reality in BIGC, the major of Polymer Materials and Engineering is mainly about the modern printing and packaging materials and related industries, especially introduce the polymer materials in the printing, packaging and other industries applications. The core course of this major contain polymer synthesis, polymer structure and performance, polymer characterization, polymer molding processing and material modification. It embodies the spirit of the times and adapts to the requirements of social, economic, scientific and technological development. It has the basic knowledge communication on polymer science and engineering, and at the same time, has the mission in improving the international view of students.
Basic Ideas of Course Construction on Progress in Polymer

Introduction of the Course on Polymer Materials and Engineering

The mainly kinds of curricula about Polymer Materials and Engineering are general education courses, academic foundation courses, specialized courses and practical courses. Among them, the professional core courses contain polymer chemistry, polymer physics, materials science and engineering foundation, polymer synthesis principle and technology, printing and packaging materials science, polymer materials molding and processing, polymer research methods, information recording materials and applications.

General education courses and disciplines basic courses are commonly scheduled during the freshman and sophomore, and academic foundation courses and specialized courses are usually scheduled during the second semester in sophomore and junior, and the internships and graduation design are arranged in senior year.

From the point of view of professional courses, the arrangement covers a wide range of courses, ranging from ideological and political courses to physical education courses, from advanced mathematics, university physics and other basic courses to polymer chemistry, polymer physics and other core major courses. It can be said that the educational system cover the moral, intellectual, physical and other aspects.

Shortcomings of the Education on Polymer Materials and Engineering

The fundamental task of the school is education. Students are the foundation of school survival and development. Majors are the carrier of the students. The scientific training program and its effective implementation way can ensure a efficient professional education. Combined with the development of the school and the actual situation of student education, the professional training programs and curriculum arrangements have been explored and improved from the major established in BIGC. Although the major set up a wide range of courses, and set up many course categories, there are many problems during the specific implementation process. For example, it is necessary for a student to learn the Inorganic and Analytical Chemistry course during the freshman year. Because the basic knowledge of inorganic chemistry is involved in the later learning process of chemistry courses. However, the best learning process of Inorganic and Analytical Chemistry is to take a combination of practical and theoretical learning, although there are experiments arrangement at the end of the semester, students responds that they did not achieve good effects, taking experiments into lectures may be more conducive to the understanding of knowledge. Physical Chemistry is an essential course, however most students are not interested in learning it. Many students generally reflect this course too difficult to understand, whether it is theoretical knowledge or data calculation.

Furthermore, when talked about the importance to learn Polymer Materials and Engineering for individual development, especially why established this major in BIGC featured in printing and packaging, many students have shown a confused demeanor. It is also the first germination to introduce the latest cutting-edge progress on polymer to the students.

Purpose and Basic Ideas on Progress in Polymer Curriculum

According to the Polymer Materials and Engineering professional training program, the graduates of this major need to know development of cutting-edge dynamic in the Polymer Materials and Engineering field with international perspective. However, there has not course on the latest developments in the Polymer Materials and Engineering field to introduce the development of cutting-edge dynamic systematically. The purpose of the Progress in Polymer curriculum is to help students understand the cutting-edge of the profession and the development trends, and establish an international perspective that is compatible with the actual scientific development. This course is mainly suitable for the undergraduates of Polymer Materials and Engineering, and introduces the latest research and application progress in polymer. And the students can know some of the new polymer materials, the actual development of the products, polymer forming principles, the key technologies and application bottlenecks. As this course requires a certain basic knowledge of polymer chemistry, it is recommended to arrange this course for the third grade students of Polymer
Materials and Engineering, and the rest of the printing and packaging students interested can take as an elective course.

**Basic Contents of the Course Construction on Progress in Polymer**

**Curriculum System of Progress in Polymer**

According to training objectives of Polymer Materials and Engineering in BIGC, the graduate students can be suitable for the printing and packaging materials and other polymer materials in the field of scientific research, technology development, production and management. Therefore, the Progress in Polymer course will focus on the latest advances on polymer materials in the field of printing and packaging.

**Green ink Polymer Materials.** Recently, the printing industry is facing more and more great environmental pressure, the printing ink commonly contains organic solvents which will be discharged after used almost without any treatment into the atmosphere directly, resulting in the organic volatile organic matter (VOC) emissions up to several hundred thousand tons annually. Generally, printing inks also contain lead, chromium, cadmium, mercury, arsenic, barium and other harmful heavy metal components which will have great harm to human body and the environment. For the aim of environmental protection, it is inevitable to develop and improve environmental friendly green inks. And it has great benefit for the students on Polymer Materials and Engineering to understand the development of green ink polymer materials to enhance them the professionalism.

**Photosensitive Polymer Materials.** In the printing industry, the pre-coated photosensitive (PS) plate has been widely used is a kind of photosensitive polymer product, it can be divided into two categories: positive PS plate and negative PS plate. With the great needs and strict quality requirements in the printing industry, it will certainly bring a huge development prospects of photosensitive polymer materials.

**Biological Organic Polymer Materials.** Medical bio-organic polymer materials are of very rapid development in recent time. The biological organic polymer materials, polymer drugs, polymer artificial tissues and organs, polymer medical materials, have made a considerable contribution in the targeted delivery of drugs, organ replacement, orthopedic surgery and expand the scope of treatment. With the development of 3D printing technology, we must pay more attention to the progress of related biological organic polymer materials.

**Biodegradable Packaging Polymer Materials.** Polymeric materials have been widely used since the 20th century for their excellent mechanical properties, good durability and low cost. However, due to its durability in the environment, it is also growing attention to waste polymer materials induced environmental pollution. The biodegradable packaging polymer materials are of global concern in nowadays.

**Smart Packaging Polymer Materials.** Intelligent polymer material is a new material research field. Intelligent polymer materials, also known as smart materials, stimulus-responsive polymer or environmental sensitive polymer, is an important component of intelligent materials. Polymer materials, through the molecular design and organic synthesis, can obtain some advanced features like living beings: such as self-cultivation and self-proliferation, recognition and identification capabilities, stimulus response and environmental strain energy and so on. It is different from ordinary functional materials due to it has a response function, and closely related to bionic and information. Its advanced design ideas have been known as a major leap in the history of materials science and has attracted great interesting from the governments in the world to a variety of disciplines scientists.

In addition, the latest advances on polymer science in aerospace, medical and health, agricultural and environmental protection, construction, automotive and other fields can be expanded in the classroom to improve student professionalism and learning interest.
Classroom Teaching and Innovation on Progress in Polymer

Curriculum is the important foothold of teaching reform. It has a very close relationship between curriculum construction and education quality improvement. At present, although the curriculum reform and innovation in higher education has made some progress, however, the content of the course still has the problem of emphasis knowledge point and look down on practical ability training, which leads to the student lack of learning interest. How to effectively organize and innovate classroom teaching is essential to the educational reform. This course will introduce to students about the latest advances on polymer science in the world via the following aspects of classroom teaching innovation. First, in the era of internet+, mobile media and other high-tech means will be used to obtain information in the classroom teaching process, dissemination of knowledge to enhance student’s interest in learning[4]. Second, combining the teacher lecture and group discussion to develop students self-exploration ability and teamwork ability[5]. Finally, based on the scientific research interest and ability of teachers, emphasizing scientific research, technological progress in the material innovation, the importance of market share, to stimulate students’ innovative entrepreneurial awareness and ability.

Practice on Progress in Polymer

As professional courses of Polymer Materials and Engineering, Progress in Polymer is a practical natural science. Many students reflect that they had understood a lot of theoretical knowledge, however, they had little perceptual knowledge after learning this course. In the new curriculum system, the engineering practice training will be as the focus of teaching research and reform to establish and perfect the new experimental teaching system. Therefore, during the learning process, besides the common classroom teaching, the practice training for the development of comprehensive quality are important equally. Pay attention to cultivate students’ practical ability and engineering consciousness, strengthen students’ ability of innovation and entrepreneurship[6-7]. Many methods can be adopted, for example, study and discuss the relevant contents and frontier issues of the course after class time, visit the relevant large production enterprises, understand the market demands and development bottlenecks.

Assessment Form on Progress in Polymer

As a traditional way of evaluation learning effect in the teaching process, the closed book examination has some drawbacks, especially to the optional course. For the aim of more rational assessment, the routine homework-experimental report-research reports combination assessment system was proposed[8]. Pay attention to the evaluation of the routine learning status, including classroom attendance, class listening, self-study, homework quality, etc., which is a more comprehensive assessment. Focusing on the evaluating students in the experimental teaching about thinking ability, practical ability and innovative thinking ability. Through the basic training of the experimental course, students can improve the experimental practical ability, furthermore consolidate the content of the classroom teaching, and obtain the good teaching effect. The research report is mainly about a related subject to conduct a comprehensive investigation. The subject can be designated by the teacher or by students themselves on their interested fields. The content mainly about polymer materials market conditions, application areas, trends and difficulties. Through the active participation in research, students can be stimulated out self-learning ability and explore ability to new topics.

Summary

How to constantly perfect the training program and to further improve the personnel training, all of these are the issues needed to consider in modern high education process. The revision and perfection of the personnel training program must aim to improve the personnel training quality and constantly carrying out the theoretical research and practice exploration on the training mode reform. At present, based on the wide professional training mode, many relevant professional courses in the teaching
system have been widely recognized and promoted. Progress in Polymer course in BIGC will provide more professional basis and international perspective for the Polymer Materials and Engineering professional students.

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