

Teaching Exploration and Practice of Industrial Catalysis

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Abstract

The idea of running a school is to cultivate higher level of special application-typed and technical person in transformation period, take the characteristics of Industrial Catalysis into account, the teaching course of Industrial Catalysis should originate from how to draw the study interest, and attempt to reform the course by means of teaching method, great attention must be paid to linking theory with practice, many closely related to the Industrial Catalysis principles examples are enumerated, and led students participant in teaching to stimulating student's interests and help them to realize the charisma of Industrial Catalysis. After applying this approach, we have achieved good effects in the teaching of Industrial Catalysis.

Keywords

Industrial catalysis; Teaching exploration; Participation in teaching.

1. Introduction

At Catalysis is a common natural phenomenon in the nature, and catalysis almost covers the whole field of chemical reaction. Catalytic technology is the cornerstone of modern chemical industry, catalytic science and technology to the development of the whole human society to promote the role is incomparable. At present, more than 95% of the chemical industry and related processes involve the knowledge of catalysis. Human life activities are also closely related to catalytic reactions. Such as catalytic synthetic ammonia and chemical fertilizer production technology solved the problem of the 6 billion men, ziegler-tower catalysts and three major synthetic solve the needs of human to wear and use, petroleum refining catalytic technology has solved the human line needs, three-way catalyst, such as environmental management to solve the requirement of the human survival environment, and asymmetric catalytic synthesis of medical technology to ensure the human health life and extend human life... The above work has not only solved the needs of human survival, but also greatly improved the quality of human life, which is a milestone of the contribution of catalytic science and technology to human society. Industrial catalysis can not only promote the upgrading of the traditional chemical industry, but also be the core technology of new energy development and high and new technology in the environmental industry, making an important contribution to the sustainable development of society and economy [1].

Industrial catalysis is an application course with rich content, comprehensive and strong practicality. With the development of catalysis theory and technology, the catalyst update speed is very fast. As chemical engineering and technology professional elective courses, the main task is to: make the students master the basic rule of catalyst and the chemical nature of the catalytic process, familiar with the basic requirements of industrial catalysis technology and the characteristics and preparation methods of catalysts used, the understanding of the frontier development of catalyst, to cultivate chemical process class professional engineers to provide a solid theoretical basis [2, 3]. As is known to all, the chemical industry is an important industry of the national economy, and the research and development of catalyst is one of the core problems of modern chemical industry. Therefore, the teaching effect of the course "Industrial

Catalysis" plays a decisive role in the training quality of undergraduates of this major and the quick adaptation of students to work after graduation. In the period of transformation and development, our school, proceeding from the reality, insists on changing its school-running idea to cultivate application-oriented and technical-skilled talents, and to enhance students' employment and entrepreneurial ability. In line with the teaching application, but the wuding method, on the principle of methodology, according to the transformation of development needs, combining the characteristics of this course, the author in the process of "industrial catalytic" teaching, has been thinking about how to give full play to the students' enthusiasm and initiative, making it better to master the course of professional knowledge, understand more catalytic development frontier. Therefore, the author has carried on the reform and the exploration to the teaching process of this course. In order to meet the requirements of cultivating applied talents under the new situation, this paper discusses the teaching reform of the course "Industrial Catalysis" in applied colleges and universities from the aspects of teaching content, teaching methods and means, etc., focusing on selecting some chapters in the course for students to teach by themselves, and the students' participatory teaching has also achieved good results.

2. Stimulate the Desire for Knowledge and Inspire Students' Thinking

Professor Yishou Zhi said that students only got a mouthful of water from a bucket of water prepared by teachers, rather than a glass of water or a bucket of water, which is far from achieving the expected teaching effect [4]. What if students don't want to learn, and no matter how well prepared a teacher is, it doesn't matter? Teachers, preaches, impart knowledge and solve doubts also. In the classroom teaching, we should pay attention to the students in the present teaching system of confusion, analysis of their living thoughts, will be a person, professional thoughts, curriculum learning combined. Teaching activity is not an immutable teaching process, not a simple process of instilling knowledge to students, but a complicated system engineering. When a teacher prepares a lesson, he should prepare not only the training plan, the outline and the teaching material, but also the students. Fully understand the students' grasp of basic knowledge, according to the feedback of students in the learning process of a variety of information, the teaching content to be appropriate adjustment, determine the teaching key and difficult points. This course is offered in the sixth semester of chemical and materials major in our college, aiming at students who have mastered the relevant basic knowledge of this major and have good self-learning ability. To further excavate its potential, encourage and guide the students to be self-taught course content into PowerPoint (PPT) format, and brave took to the podium, teach their students, as well as the other students in the class to give lectures to evaluate students, so that students under certain pressure, give full play to their learning enthusiasm and subjective initiative, and good exercise, the students' understanding of the new knowledge, inductive, content and language logic, organization and clearer about ability.

3. Focus on the Introduction and Stimulate the Interest in Learning

The introduction part is the opening part, which is the first window for students to understand and learn the course. The success of the introduction course is directly related to students' interest in and enthusiasm for learning the course. In the initial teaching process, the author first introduced the learning content of this subject and then emphasized how important this course was. However, the effect was not satisfactory and there was always a feeling of empty preaching. After several years of teaching practice, I continue to find problems in teaching, summarize experience, explore new teaching methods, and redesign the content of the introduction in combination with the needs of transformation and development.

We begin the course with the successful flying of god 11. China's manned space program can achieve today's brilliant achievements that attract the attention of the world. Condense the wisdom and wisdom of several generations of scientific and technological personnel and the spirit of overcoming difficulties. Among them, the catalyst plays a vital role in the precise control of the flight trajectory and attitude adjustment of the spacecraft after liftoff, which is called the "rudder" of "Shenzhou spacecraft". According to the news of "Shenzhou-11 Flying Apparatus", which is popular with students, the introduction of catalyst is very important in production and life.

The formation of scientific knowledge comes from life. To understand science and flexibly apply scientific knowledge, it is necessary to connect scientific knowledge with real life. Industrial catalysis is a subject gradually developed with the continuous progress of chemical production. It has strong generality, application and practicality, and is closely related to actual life. If you want to wash blood stains, milk stains, juice and so on on clothes, the use of enzymatic washing powder can obtain good stain removal effect. The simplest human activities, such as digestion and metabolism, require the participation of catalysts. Through the introduction of the study, based on real life problems, combining the industrial catalytic professional knowledge and practical life, 1 from life to theoretical derivation and interpretation of the teaching mode, teaching more than common knowledge GuanShuXing guidance and targeted, can better guide the student to clear the purpose of industrial catalytic course study, stimulate students' curiosity, inspire the student to actively to find problems in life, to make the students more love to science.

4. Increase Case Teaching to Broaden Students' Knowledge

In order to cultivate students' interest in learning, the famous scholars and inventors involved in the teaching content are introduced in the teaching process, such as Haber, Ostwald, Langmuir, etc.; Ostwald [5] summarized many experimental results and defined catalysis according to the laws of thermodynamics. Almost a century since then, the basic ideas have changed little. He also published The General History of the Theory of Contact Action (1898), and in 1909 won the Nobel Prize in Chemistry for his work on catalysis, chemical equilibria and rates of chemical reactions. He was the first scientist to win a Nobel Prize for catalysis. Ostwald's understanding of the nature of catalysis was quite distant from the modern view. Ostwald believed that the role of a catalyst was simply the concentration of reactants on its surface. It was the pioneering work of Langmuir [6] that raised our understanding of the nature of catalysis to a new scientific level. Langmuir's work caused chemists to completely abandon the idea of catalytic force. The 1932 Nobel Prize in Chemistry was awarded for the study of the adsorption of various gases on metal surfaces, which deepened the understanding of heterogeneous catalysis and its mechanism. On July 2, 1909, Haber [7] succeeded in artificial nitrogen fixation in the laboratory under the conditions of 600°C, 200 atmosphere pressure and metal iron as catalyst, and the concentration of ammonia reached 6% after balance, making a breakthrough for the first time. In 1911, Baden built the world's first synthetic nitrogen plant with a daily production of 30 tons in Auburg, Germany. This is a major achievement of artificial nitrogen fixation technology of world significance. It is the first milestone to realize high temperature, high pressure and catalytic reaction in chemical production. In 1918, the royal Swedish academy of scientists decided to award him the Nobel Prize in chemistry for his contribution to the invention of synthetic ammonia, and for his contribution to the development of chemical weapons

The catalytic phenomena often encountered in daily life are introduced, and the catalytic principle is analyzed, such as the discolored glasses, the burning of sugar cube, etc. In hot summer, people need to wear color-changing glasses to resist the strong sunlight in order to

protect themselves from the sun. The reason why glasses change color is a catalytic phenomenon. Photosensitive substances such as silver halide and a small amount of copper oxide are pre-mixed in the manufacturing process. Under the action of light, the silver halide decomposes into many black silver particles, which are evenly distributed on the lens, making the lens appear dim. But when the light dims a bit, the halogen and silver atoms that break up in the presence of copper oxide recombine to form silver halide, and the lens becomes transparent again. The sugar cube is not combustible when it meets fire, and the combustion after adding a little soot is also the use of trace elements in the soot to play a catalytic role. And most of our washing powder now joined the A molecular sieve, is to use it to soften the water quality and adsorption of dirt. This phenomenon also shows that molecular sieve is more environmentally friendly than liquid acid, a solid acid catalyst, it has a large specific surface area, regular pore structure, excellent adsorption and ion exchange performance. Not only can solve the problem caused by homogeneous reaction, but also non-toxic, non-corrosive, can be used in the range of high temperature. Through the narration of this life phenomenon, students can better understand the solid acid and alkali.

5. Integrate Teaching Content and Involve Students in Teaching

The textbook used for this course is Industrial Catalysis (the third edition) [8], edited by Huang Zhongtao and Geng Jianming and published by Chemical Industry Press. This textbook is one of the commonly used textbooks in Industrial Catalysis at present. The textbook contains a total of 12 chapters, of which the first four chapters mainly describe the basic concepts of catalysis, the mechanism of action and the common types of catalysts. The middle four chapters mainly focus on the new development of catalysts in the field of new materials and new energy. The last four chapters are about the design, preparation, testing and characterization of catalysts. According to the talent training plan and specialty characteristics of chemical engineering and related majors in the transformation and development period of Zhoukou Normal University, the limited teaching hours are reasonably allocated and arranged, the traditional content of the course is simplified and updated, and the new technology and new application of industrial catalysis are added to the tradition to keep up with the development status of industrial catalysis. According to the teaching reality of the college and the characteristics of students, teachers will explain the contents of the first four chapters and the last four chapters. Through the study of these two parts, students have mastered the principles, classification, design principles, preparation methods and characterization methods of catalysis, which will lay a solid foundation for students to read professional literature on catalysis and engage in further research related to catalysis. The middle four chapters are for students to participate in the explanation. Divide the students into four groups. Each group will explain one chapter. The middle four chapters are the new field of catalyst application, and the content is time-sensitive. Students are required to consult relevant information and track the latest developments. Clear the main line, grasp the key points, summarize and refine the content, organize the relevant content and make it into PPT, and then explain. Cultivate students' self-study ability, promote the development of classroom teaching and improve the quality. After the practice in recent years, the ideal effect has been obtained. For example, Chapter 9 is about the catalytic technology of new energy and fuel industry. Through a large number of literature review, students chose biomass as the focus of their teaching, and explained the sources, advantages and disadvantages and applications of biomass energy. Through the study of this lesson, students have learned that a lot of waste in our life can be applied to production and life as biomass energy. In this way, students' ability of reading, summarizing and summarizing problems, making PPT and oral expression have been well exercised. In addition, update, and integration of teaching content, we also study of the features and the teacher with the university research direction is consistent, in the theory explain at the same time, with the colleges and

universities teachers' scientific research as an example, some students have great interest to this, ask for early access to the laboratory for catalyst preparation related experimental work, thus enhances the initiative of students to participate in the graduation design and graduation practice link. From the classroom effect, compared with other catalytic content deviating from the school's characteristics, students are more interested in learning this part.

6. Conclusion

In the period of transformation and development, it is required to focus on improving service ability and talent training quality to achieve all-round transformation. According to the requirements of transformation and development, the goal of the course construction of chemical thermodynamics is to train high-quality, multi-skilled and innovative applied talents. By applying the basic knowledge to the practical process, students will grow into talents with both solid basic knowledge of chemistry and the ability to solve practical problems through the study of this course. Combined with the needs of transformation and development and the characteristics of chemical thermodynamics course, enhance emotional communication with students, reconstruct the chemical thermodynamics course system, and increase case teaching. In this way, students can not only eliminate the traditional fear of thermodynamics, grasp the knowledge of chemical thermodynamics in a relaxed and pleasant atmosphere, but also teach students how to behave and do things, love their major, so as to better serve the society.

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