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# Present Situation and Development Countermeasures Vocational Education for Refractory Industry

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**Abstract:** With the rapid development of high-temperature industry, China has become the largest country in the world in the production, consumption and export of refractory products. However, the technical quality of front-line employees in refractory enterprises is generally low. Especially with the continuous upgrading of refractory production equipment, process and quality control, the problem of lack of technical and skilled personnel is becoming more and more serious. From the perspective of vocational education, and in-depth investigation on the development of refractory industry and its personnel status, the main problems existing in refractory industry vocational education are analyzed. It is found that there are few vocational colleges offering refractory material specialty (direction), there are few teachers with refractory major background, refractory material specialty is difficult to recruit students, and the training conditions are poor, the content of teaching materials for refractory material specialty course is outdated, and so on. Based on the above problems, some countermeasures are put forward, such as increasing the cooperation between factory and school, government support, letting students and their parents know that refractory material major does not belong to high energy consumption industry, but green manufacturing industry in the field of new material technology, raising the salary and welfare of skilled workers in refractory enterprises, and developing refractory vocational education undergraduate course.

**Keywords:** Refractory, Vocational Education, Countermeasures

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## 1. Introduction

The rapid development of iron and steel, non-ferrous and petrochemical high-temperature industries, as well as the continuous progress of key equipment and technology, has greatly driven the scientific and technological innovation and industrial development of refractory materials in China. China has become the world's largest producer, consumer and exporter of refractory materials and refractory raw materials [1-2]. At the same time, colleges and universities or scientific research institutions engaged in refractory or related majors have made great progress in the past decade. According to statistics, China is engaged in refractory education faculty and enrollment in all ranks first in the world, but refractory is an applied discipline, refractory industrial enterprises still lack of production, management, service line technology applied talents, in every section of workshop, laboratory, quality inspection jobs such as the lack of corresponding have certain professional knowledge and

skills of operating personnel, Especially with the continuous upgrading of refractory production equipment, process and quality control, as well as the high requirements of intelligent operation for personnel specifications [3], refractory enterprises lack of technical and skilled personnel more and more prominent problems. In this paper, from the perspective of vocational education, in-depth research on the development of refractory industry and talent demand status of industrial and mining enterprises, analysis of refractory industry vocational education problems, put forward some countermeasures and suggestions.

## 2. Present Situation and Existing Problems of Refractory Enterprise Professional and Technical Personnel

There are many refractory enterprises in China, with small scale and scattered scale, uneven technology, control

technology and equipment level, advanced production mode and backward production mode coexist [4-6]. The professional and technical personnel in these enterprises differ greatly and their problems are also different.

### **2.1. Leading Large Enterprises**

Shares in recent years, in order to ruitai technology, xiaoyi, Beijing and other large refractory represented by leading enterprises gradually grow up, these companies not only pay attention to production, but also pay attention to product research and development, so engineers more technical personnel structure is relatively reasonable, especially in recent years, along with corporate restructuring, whether state-owned enterprises or private enterprises, High-level talents are also concentrated in leading large enterprises. However, according to the survey, these enterprises are still in short supply of high-tech application-oriented technical personnel and operational personnel, especially those enterprises with modernized technological process and equipment. In the enterprise, both the basic management personnel engaged in process control and equipment management, and the operators engaged in raw material processing, blank forming, product firing and other central control room, in terms of quantity and quality, can not meet the present and future development requirements.

### **2.2. Small and Medium-sized Enterprises**

Due to refractory material required for the initial investment is relatively small, low threshold, refractories are numerous small and medium-sized enterprises, most of these enterprises in scale, the modernization degree than a large enterprise, paid attention to only commonly, production does not pay attention to research and development, the graduates of bachelor reluctant in these companies, engineers more than technical staff is limited. Most of the operators of all posts are recruited by the society after training, the cultural quality of the employees is generally low, lack of development momentum, especially today when the state advocates energy conservation and emission reduction, quality improvement and consumption reduction, these enterprises are facing greater pressure to survive, it is difficult to bear the cost pressure brought by raising workers' wages and improving welfare. In the end, low wages, low technology, low labor productivity vicious circle.

### **2.3. Employment Status of Refractory Material Professional Higher Vocational Students**

Due to the different scale and technical level of enterprises, vocational students working in different refractory enterprises often face a dilemma. On the one hand, some enterprises realize the lack of investment in RESEARCH and development, but the lack of high-tech personnel, had to let some vocational students engaged in refractory technology research and development, industrial design, these vocational students generally feel the lack of relatively complete theoretical knowledge system, engaged in product research,

design work face many difficulties, powerless. Because after years of enrollment expansion of colleges and universities, college level education gradually relegated to vocational education, despite the higher vocational and college degree is the same level of specialized subject, but the purpose of vocational education is to develop a certain cultural level and professional knowledge skills applied talents, compared with record of formal schooling education, vocational education focuses more on the practical skills and abilities in actual work. Large those leading enterprises, on the other hand, high technical level, high level human resources relatively abundant, and in production line work of higher vocational graduates think theoretical knowledge learned more, narrow marketability, content, learning content and professional post demand gap is bigger, an urgent need to process operation skills such as training, improve operation skills, the ability to deal with failure.

In addition, refractory material professional higher vocational students generally believe that the lack of opportunities for re-education, promotion of professional title limited. According to the national policy, graduates of higher vocational education can apply for undergraduate (upgrade), graduate education to continue their studies. But in fact, refractory material major is not like other popular major, there are corresponding to enter the high-level undergraduate education, graduate education, some students want to upgrade this, can only be changed into other major. And because the refractory material specialty is narrow, the volume is small, it is difficult to carry out skilled professional qualification certificate like lathe worker, maintenance worker, surveyor and so on. At the beginning of this century, China Iron and Steel Association once hosted the professional qualification examination of refractory specific jobs. However, due to inadequate policies, insufficient cooperation between schools and enterprises, the professional qualification certificate could not be recognized by enterprises, and the professional qualification examination of refractory specific jobs was stopped for a long time.

## **3. Present Situation and Existing Problems of Refractory Vocational Education**

### **3.1. There Are Few Vocational Colleges Offering Refractory Material Major (Direction)**

Vocational education is closely related to the professional characteristics of refractory material and refractory material in the Ministry of Education higher vocational professional directory, there is no specific Settings, higher vocational colleges generally it belong to a branch of material engineering, material engineering technology professional don't like electrical and mechanical, electrical, computer and other professional knowledge system and distinct, secondary, vocational, undergraduate course knowledge boundary is clear, The specialty is more theoretical and requires more

knowledge of physics and chemistry. According to statistics, in the national vocational colleges, there are no more than 20 schools offering materials engineering majors, and fewer schools offering refractory materials majors (direction), in addition to adding refractory materials professional classes at higher vocational levels irregularly in Wuhan University of Science and Technology, Liaoning University of Science and Technology [7], only Shandong Industrial vocational College, Luoyang University of Science and Technology (the original Luoyang Industrial college), and this year, Zhengzhou City vocational College of materials engineering college has a fixed enrollment plan.

### **3.2. It Is Difficult to Recruit Refractory Students in Higher Vocational Colleges**

Refractory enterprises give people the impression of silly, big, coarse, labor intensity, poor environment, high pollution, low technical content. Candidates are not willing to enter for refractory material major. Take Shandong Vocational College of Industry as an example, in the past decade, the enrollment rate of professional enrollment is less than 30%, even the single entrance examination of the college entrance examination is not attended, refractory material major is facing a severe challenge of suspension, and this suspension is not caused by the employment rate index required by the Ministry of Education. In fact, refractory employment prospects, employment rates, wages are not low.

In addition, in order to improve the scale of running schools, vocational colleges mostly focus on expanding the number of students. In the recruitment of students, often blindly comply with the mentality of pleasing parents and students, exaggerate the facts, misleading the publicity, leading to some parents and students can not make a scientific and rational judgment on the professional content, professional prospects, this phenomenon has an adverse impact on the minority of refractory material major.

### **3.3. Status Quo of Full-time Teachers**

Vocational colleges teachers generally after graduation directly on the platform, although has certain teaching ability, but little contact with the factory, the production equipment, and deep understanding of the process, the lack of necessary professional practice skills, and so less information, lecture theory and production link is not much, to come up with more real cases to teach students. An investigation on the professionalization of teachers in higher vocational colleges shows that the professional practice and operation skills of teachers in higher vocational colleges are most lacking at present.

Survey also found that due to materials professional compared to other professional, belong to the multidisciplinary cross, the specialized direction, including metal, nonmetal, polymer materials, photoelectric materials, etc., as a result, there is no lack of in higher vocational colleges materials professional background of teachers, but with almost no professional background of teachers,

refractory are mostly by other related professional career.

### **3.4. Current Situation of Teaching Materials for Specialized Courses**

The current teaching materials for refractory materials are mostly based on the compression type of undergraduate and the promotion type of technical secondary school, and the content has not been effectively linked with the vocational appraisal standards. In principle, the compilation of teaching materials for vocational education should be done by teachers, engineers and experts together, but it is difficult to achieve trilateral cooperation. Therefore, the content of teaching materials is outdated and does not meet the development requirements of new refractory technology and new technology.

### **3.5. Conditions of Practice and Training**

The operation of each position in refractory material production is relevant. Unlike car, pliers, electricity and other majors, one person can independently complete a professional activity process, such as turning of lathe worker, scrapping of fitter and wiring of electrician before board, etc., schools generally have such training conditions. But the skill training of each position of refractory production can not do this. At present, no refractory enterprise in China is willing to provide training and skill examination places for students in school, and most schools do not have the conditions of simulation operation.

## **4. Suggestions on the Development of Refractory Vocational Education**

### **4.1. Strengthen Publicity and Improve the Salary and Treatment of Technical Personnel**

Refractory industry has been called "hidden industry" and "basic industry" for high temperature materials [8], the new refractory materials meet all kinds of industrial furnace lining longevity, domestic energy needs as its service goal, therefore, not only does not belong to energy-intensive industries, but green manufacturing hi-tech industry, belong to the new material technology. As the behind-the-scenes hero of the national high temperature industrial field, its development will not stagnate, but will only grow stronger. Vocational college refractory material professional graduates into refractory enterprises will soon be able to display their own talent, but we lack this aspect of publicity, not more people know. Of course, it should also be seen that in refractory enterprises, in addition to the higher labor intensity of molding workers, the higher salary, equipment inspection, quality inspection and raw material processing, billet preparation, products made of posts such as wages are still low, should be appropriately improved.

In addition, parents and students should also know that the "cold and hot" of majors is never absolute, let alone immutable. Switching between professional "cold" and "hot"

can happen faster than many people think [9].

#### **4.2. Increase Factory-school Cooperation and Government Support**

Doing well refractory material vocational education must have capital input. Governments at all levels in china pay more and more attention to the teaching development of higher vocational education, enterprises and schools should strive for the support of government special funds [10]. Students receive education in the school, and then go to the production site to practice operation, can really achieve the theory with practice and learn to use. Therefore, the school needs the support of enterprises to provide convenience for students to practice in the factory. It is best for the factory engineers, technicians and post operation technical workers to teach students and guide students to work on the premise of not affecting the normal production operation. Of course, businesses and schools need special funds to support them. Establish the mechanism of cooperation between colleges and enterprises to train talents, and implement the new mode of "order" education and training. Schools should enhance service awareness and actively meet the needs of enterprises; Companies relying on school for the new staff training and on-the-job worker training, and college talents training contract, if the cooperation colleges and universities graduates, and actively participate in school education and training activities, in determining the training goal, knowledge, skills and talent specification structure, curriculum, teaching content and learning outcomes assessment play a leading role [11-13], Establishing a school-enterprise cooperation system conducive to the sustainable development of higher vocational education.

#### **4.3. Build an Excellent Team of "Double-qualified" Teachers**

"Double teacher" quality teacher refers to the teacher who can not only engage in teaching and research, but also engaged in process management, technical transformation, etc., which plays a very important role in vocational education [14]. Therefore, the school should intensify efforts to organize teachers to work out in a planned way, follow engineers and post technical workers to practice, understand and master the production status and post characteristics and new technology, new technology for theoretical and practical teaching reserve resources [15]. On the other hand, engineers and technicians work in the production line, the introduction or employment of them as professional course teaching and practice guidance, will play a positive role in the realization of training goals. It can be considered to establish a mobile station for part-time teachers from outside the school to enrich the quality of "double-qualified" teachers.

#### **4.4. Accelerate the Establishment of Vocational Education of Refractory Materials**

Developing undergraduate vocational education is a key link to improve the modern vocational education system, and

the national policy for developing undergraduate vocational education has been clearly defined [16]. In September 2020, the Action Plan for Improving the Quality and Quality of Vocational Education (2020-2023) issued by the Ministry of Education and other nine departments clearly points out that "Support eligible high level with Chinese characteristics of higher vocational school construction unit of the vocational education undergraduate professional pilot program", the pace of transformation and upgrading of China's industry has reshaped the vocational education essence connotation and explicit form, refractory materials are from the labor-intensive and resource-intensive industries to technology innovative industry shift, is by the "manufacturer" to "general contractor", Extending from "product value" to "service value", these changes of production mode and organization form put forward higher requirements for industrial workers. Accelerating the development of refractory vocational education at undergraduate level is an inevitable requirement to adapt to the transformation and upgrading of Refractory industry in China.

## **5. Conclusion**

Refractory industry from big to strong, from strong to new, the key in science and technology, the foundation in education. In this paper, the present situation of professional and technical personnel in refractory industrial enterprises is investigated from various angles, and some problems existing in refractory vocational and technical education are analyzed. Some countermeasures and suggestions are put forward on the training and construction of refractory applied personnel.

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## Biography

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