

# Exploration of The Reform of The Training System for Full-time Master's Degree Students in Materials Under the Background of Academic System Reform

Guannan Chu, Xiaojun Liang, Lei Sun, Lei Li, Fa Liu

Harbin Institute of Technology, Weihai, China

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**Abstract:** The Department of Materials Science and Engineering was established in 2001 at the Weihai Campus of Harbin Institute of Technology, and the first batch of master's students majored in materials processing engineering was officially enrolled in the same year. Since 2009, the structural type of master's education has been significantly reformed, and the first batch of applied master's students in materials engineering was admitted in 2011, in line with the Ministry of Education, to enhance the ability of graduate students to serve the national and social development, and increase the training of application-oriented talents. General Secretary Xi Jinping pointed out in the report of the 19th National Congress that it is necessary to deepen the integration of industry and education. In response to the country's acceleration of the high-quality development of professional degree graduate education in the new era, our university will admit the first batch of full-time professional degree master's students in 2022, extending the duration of study from two years to three years, and many issues such as curriculum system setting and professional practice requirements in the whole process of training need to be explored.

**Keywords:** Postgraduate education, Professional degree master's students, Integration of industry and education.

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## 1. Introduction

In any society, talent is the decisive factor in determining the future of national and social development. Today's world is no exception, human resources have become strategic resources to improve comprehensive national strength and international competitiveness, knowledge has become a factor to promote the formation of human resources and promote economic and social development, so countries have taken the development of education as a strategic measure for national development. In our country, whether or not we can train and bring up hundreds of millions of high-quality workers, tens of millions of specialized personnel, and a large number of top-notch innovative talents has a bearing on the construction of socialist modernization in our country. Our national education system consists of four parts, namely, basic education, secondary vocational and technical education, general higher education and adult education. Among them, postgraduate education is the high-end of higher education, and it is an important way for the state to select high-level specialized talents and top-notch innovative talents. Postgraduate education is a form of education in which students continue to study and study after graduation, which can be divided into master's degree education and doctoral education. Du Yubo, Vice Minister of Education, pointed out that there is still a big gap between the quality of China's postgraduate education and the development of the country and the needs of the people, and it is necessary to accelerate the transformation from academic talent training to equal emphasis on academic and application-oriented talent training, and accelerate the transformation of master's education from academic to application-oriented. Academic postgraduate education can not meet the demand for various types of talents in today's social and economic development, while the training of applied graduate students is guided by career needs, focuses on practical ability training, and combines production, education and research as a way to

enhance the ability of graduate students to research practical problems and solve practical problems, can cultivate application-oriented high-level professionals who meet the actual work needs of specific occupations or positions in society, and can solve the problem of disconnection between talent training and actual needs in academic postgraduate training.

## 2. Explore the Necessity of Full-time Application-oriented Postgraduate Training

The 12th Five-Year Plan for the Development of National Education clearly points out that it is necessary to improve the higher education system, actively develop professional master's degree education, carry out pilot reform of professional master's training mode, and explore the training mode of combining science and education and combining industry and education; Facing the special needs of major science and technology, carry out pilot training of engineering doctors, and gradually form a postgraduate training system with balanced development of academic degrees and professional degrees. However, since the "Twelfth Five-Year Plan" scientific and technological innovation and educational reform, Harbin Institute of Technology (Weihai) material degree graduate students have exposed many problems in education and training, such as: homogeneous training of professional degrees and academic degrees; Supervisors have insufficient practical guidance ability for students, prefer theoretical research, and insufficient practical ability of graduate students; The duration of study is too short, and graduate students are nervous about studying at school; Some graduate students follow others to research and lack the ability to innovate; Lack of understanding of the current situation and development trend of technology in the field of materials and chemicals; The thesis topic deviated from practice, and the bachelor's level declined overall. In order to

get out of the above dilemma, our school has carried out reform and exploration of the training system for master's degree students in materials, and effectively improved the training quality of graduate students in materials majors.

### **3. Reform of the Academic System and Strengthening the Curriculum System**

Under the previous two-year training system for graduate students in materials majors, students needed one academic year to study courses, and in the second academic year, students had to complete their own project research, professional practice and graduation thesis writing, and at the same time faced the pressure of employment and further study. The two-year training period cannot meet the training requirements of professional degree graduate students. In addition, the training mode of professional degree master's degree and academic degree master's degree is similar, lack of practical links or implementation of practical links is not in place, and the knowledge learned in school cannot be transformed into practical ability, resulting in the derailment between cultivating talents and society. In view of this prominent problem, the basic training period of full-time professional degree master's students in 2022 has been changed from 2 years to 3 years, facing the world's scientific and technological frontier, facing the main economic battlefield, and facing the major needs of the country. Graduate students take 0.75 academic years to complete the course, and a comprehensive assessment is conducted at the time of 1.5 academic years. During the period of study, it is necessary to participate in professional practice internships and other innovation and entrepreneurship practice activities at the university-level and college-level postgraduate school-enterprise joint training base. Extending the academic system gives students more time to study and precipitate, and improves the quality of postgraduate training. The curriculum system includes "core courses + elective courses + compulsory links (including social practice and professional practice)", which not only meets the talent training characteristics of "thick foundation, strong practice, strict process, and innovation" of our school, but also meets the needs of students' personalized development. In September 2021, our school established the School of Outstanding Engineers, breaking down the barriers of interdisciplinary training of professional degree graduates, and outstanding undergraduate graduates can apply for interdisciplinary and multi-directional training of graduate students with professional degrees in materials. Through the above measures, we will effectively cultivate a group of application-oriented high-level engineering technology and engineering management talents with certain organizational management capabilities and innovation capabilities for the country.

### **4. Relying on the Scientific Research Advantages of The School, Improve the Practical Ability and Academic Level of Graduate Students**

In order to solve the problem of insufficient practical ability of full-time master's students majoring in materials, our university adopts the method of dual tutor system and the construction of joint training base, which effectively makes up for the lack of theoretical supervisors in practical ability

training and provides a good platform for postgraduate students to carry out project research, which is conducive to strengthening the integration of industry and education education and strengthening the cultivation of practical innovation ability of professional degree graduates. However, many problems have arisen in the implementation of these two solutions that need to be solved urgently.

#### **4.1. Improve the joint training of the dual tutor system**

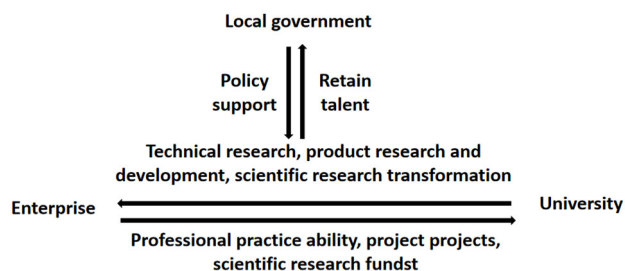
China's current dual mentorship system is generally not implemented in place and is a mere formality. There are mainly the following reasons: lack of management system, industry mentors do not clearly guide the responsibility objectives; Lack of effective communication between the two mentors, unclear division of labor; Most practice instructors have no professional teacher training; Lack of a reasonable evaluation system of "dual mentor system". In order to improve the lack of management of industry tutors, our school has passed the "Guiding Opinions on the Appointment of Industry Tutors for Master's Degree Graduate Students of Harbin Institute of Technology", which stipulates the basic requirements for the appointment of industry tutors, the responsibilities of industry tutors, and the management of industry tutors, and requires tutors who meet the basic employment requirements to complete unified training on campus before guiding students.

#### **4.2. Build a joint training base**

The construction of joint training bases involves not only enterprises, universities, tutors and students, but also local areas. The construction of the base should take into account the interests of multiple aspects, types and levels, so there are the following four problems in the construction process. Enterprises only pay attention to whether students can carry out independent innovation, so as to achieve technological breakthroughs and achieve scientific research transformation. Colleges and universities only pay attention to the improvement of students' practical ability during the practice period, and lack correct guidance for students' sense of social responsibility and professional ethics. In order to retain talents, local governments only focus on the final results of student training, and have insufficient policy and financial support for the training process. The practical content of students is not well connected with reality, which ultimately leads to a low degree of connection with the needs of the industry. In the face of this situation, through the support of local policies, we will build a "bridge" for enterprises and universities, so that both sides can put forward real needs and achieve the sustainable development of joint base training.

Enterprises hope that colleges and universities will help solve the practical problems and talent needs encountered in their production practice, while most of the teachers in colleges and universities stay on campus directly after graduation, and they have little actual industrial work experience, and it is difficult to know the actual problems in the industry. Universities hope that enterprises can improve a good platform for postgraduate students to carry out research projects, in addition, improve students' own practical ability and practical employment prospects. Students who are promoted at the base will also give priority to internship companies when recruiting, further increasing the employment rate of the local area and effectively solving the problem of brain drain, thus forming a virtuous circle of joint

training bases (Figure 1).



**Figure 1.** The mode of integrating industry and education to train professional degree master's students

### 4.3. Industry demand condensation as a research topic

In order to avoid enterprises thinking that joint training is only a form and universities are worried about the decline in the quality of talent training under the new model, enterprises solicit and put forward demand, and universities raise the demand to the height of the topic, and then condense the real needs of the industry and technical problems into postgraduate research topics. Originally, only the school participated in the whole process of professional master's students, so that enterprises can also participate in it, so as to ensure that the postgraduate training is consistent and systematic, and improve the quality of full-time professional

master's training.

In order to promote students' understanding and transformation of theoretical knowledge, the school has implemented a series of teaching reform measures. The first is to implement the dual tutor system, in which the on-campus tutor, as the first responsible person for graduate management, is jointly responsible for the training of students with the industry tutor; Second, the curriculum is the application of students in the setting practice; Third, the project is jointly participated by both the school and the enterprise and is completed simultaneously; Fourth, professional practice can only be obtained after passing the professional assessment; Fifth, the graduation project and comprehensive evaluation implement multiple evaluations. The organic integration of theoretical teaching and practical teaching builds a new training system to ensure the quality of student training.

The deep integration of industry, education and research as the link of connection, students' practical ability and innovative technology as the core, "dual tutors" inside and outside the school, and "dual platforms" in theory and practice, have taken a new path for the postgraduate training of materials majors in our university. It has improved the academic reputation of enterprises in the industry, improved the driving force of innovation, and good cooperation allows all parties to see the significance of school-enterprise cooperation and industry-education integration training, and the implementation of joint training has further mobilized the enthusiasm of all parties to participate.

**Table 1.** Comparison of master's degree students in the integration of industry and education

	Normal culture mode	Joint training of industry and education	Comparative analysis
Graduate Tutor	1 tutor on campus	Dual tutors inside and outside the school	Engineering innovation capability training
Course	The original curriculum system	New curriculum system	Application in practice
Problem	Participation only within the school	Participation only within the school	Degree of completion and contribution to the project
Practical hands-on classes	On-campus practice	Practice inside and outside the school	Evaluation of internship practice results
Graduation project	Completed on campus	Completed on and off campus	Dissertation and grades
Comprehensive assessment	More theory and less practice	Theory and practice	Overall assessment of students' comprehensive ability

Conclusion: Under the background of academic system reform and the demand for talents in the new era, the training of professional degree graduates not only requires the support of internal resources, but also the joint participation of external resources such as industries, enterprises, and social organizations, and also needs to adhere to the road of professional degree training with Chinese characteristics focusing on cultivating practical ability and building joint base training. After theoretical teaching and on-site practice on the production line, students absorb and precipitate the knowledge they have learned, which not only improves students' professional practice ability, but also improves students' vocational skills and improves students' initiative to participate in industry-education activities. So as to create a good environment for the combination of school and enterprise, promote the gathering of innovation elements to enterprises, realize the sustainable development of joint

training, optimize the structure of talent training, and adapt to the needs of economic and social development.

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