
**AC 2011-621: CONSTRUCTION AND INNOVATION OF THE DISCIPLINE
OF MINERAL PROCESSING ENGINEERING IN CHINA UNIVERSITY
OF MINING AND TECHNOLOGY**

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Construction and Innovation of the Discipline of Mineral Processing

Engineering in China University of Mining and Technology

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Abstract:

Taking the technology of the processing and utilization of coal resource and the clean coal technology as its characteristic, the discipline of mineral processing engineering of China University of Mining and Technology (CUMT) has been developing more than a century, and is a national key discipline. It has formed a passel of world advanced research achievements and becomes an important base for the education and scientific research of Chinese mineral processing engineering and it also has high position and effect in the energy research field of the world. It entered into the key disciplines of Jiangsu province and the former Ministry of Coal Industry in 1994, and was qualified to pass the inspection of the outstanding brand discipline of Jiangsu province in 2006, as well as was selected as the national key discipline and the construction point of the national special discipline in 2007. In 2008, it was selected as a national teaching group. The teaching group seriously explores the innovative teaching reform in construction of teaching faculty and the major specialized course, such as mineral processing, methods of coal preparation experimental research, design and management of coal preparation plant, mechanism of mineral processing. And a teaching group with high-level teaching faculty gradually forms by the teaching reform and specialty construction of discipline of mineral processing engineering, so as to perfects the course development of other disciplines, and improves qualities of teaching faculty. The faculty, laboratory and scientific research conditions of the discipline are introduced, and the personnel training scheme of the subject, and the courses system are also discussed in the paper. Recently, the discipline of CUMT focuses on the practice of innovation teaching of the college students and construction of engineering application ability.

Key Words: engineering practice; educational reform; mineral processing engineering

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1. Introduction

Education on mineral processing engineering has been given a high priority in China. More than 30 universities set up the major of mineral processing engineering. These universities cultivate lots of mineral processing engineering professions which meet the demand of economic development. There are about 1800 undergraduates, 500 postgraduates and 100 doctors graduate from these universities every year. China has become a big power of training professional personnel in the mineral processing field ^[1].

As one of the selected universities for the national ‘211 Project’ and ‘985 Innovation Platform Construction Project’, CUMT has formed a discipline major system with a priority to engineering, with the feature of mining, and combined with science, engineering, literature, management, law, economy and other multiple subjects developed harmoniously, developing for more than 100 years. The discipline of mineral processing engineering of CUMT was founded in 1952^[2]. Thereafter taking the processing and utilization of coal resource and clean coal technology as the feature, the discipline was going to develop and grow in strength on a never straight road. And now it takes a leading academic position and influence, being one of the national key disciplines in CUMT. It was authorized to confer master’s degree in 1981, doctoral degree in 1984 and postdoctoral scientific research station in 1985. In addition, it was selected as one of the first batch subjects that having the duty of ‘Yangtze River Scholar Prize Program’^[3].

The discipline of mineral processing engineering of CUMT was honored the key discipline of Jiangsu province and the former Ministry of Coal Industry in 1994, and was qualified to pass the inspection of the outstanding brand discipline of Jiangsu province in 2006. It was also selected as the national key discipline and the construction unit of the national special discipline in 2007^[4]. In 2008, it was honored the national teaching group and the subject of mineral processing was approved as a ‘national featured subject constructing project’. The discipline of the mineral processing engineering attained the outstanding discipline echelon of ‘Lan-Qing project’ of Jiangsu Province in 2004. And in 2007, a research echelon of this discipline (high efficient fluidization clean coal theory and technology) was selected as one of the science and technology innovation groups of Jiangsu Province ^[3]. Nowadays, the discipline makes contributions to national economic construction with the predominance and characteristics in clean coal technology, coal preparation processing, coal transformation and combustion, and pollution control, etc. The discipline structure of Mineral Processing and Technology of CUMT was shown in FIG 1.

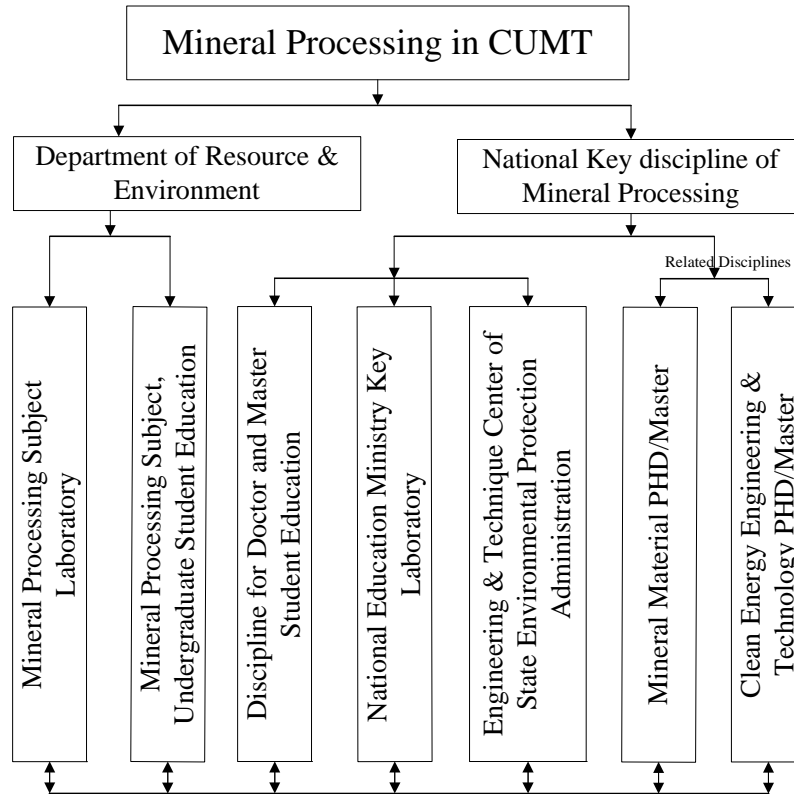


FIG 1 The discipline structure of mineral processing and technology of CUMT

2. Discipline forms the special features of coal processing

Now, coal accounts for above 70% in production and consumption of the primary energy^[3]. Recently, the consumption structure of the primary energy in China was shown as FIG 2. With about 1,000 billion tons of reserves, coal will still be a main energy source for the nation in a medium or long term. In 2009, the output of raw coal was 3.05 billions tons; the coal resource has made a great contribution to the economy and society development. Meanwhile, it also has brought serious harm and destruction on the geomorphology and eco-environment. The national discharge amount of the fuel dust and SO₂ are 9.866 and 24.681 million tons respectively, and the land area affected by acid rain is accounting for about 30%. Where, the discharge amount of the fuel dust and SO₂ comes from coal-firing are respectively 70% and 85%. Coal preparation is the source of “Clean Coal Technology” and economic and effective method to reduce the discharge amount of the fuel dust and SO₂.

CUMT was affiliated the previous Ministry of Coal Industry of China. It provides a large batch of outstanding personnel for the national coal industry. The discipline of mineral processing engineering of CUMT forms the special features of coal processing with the development and science & technology process of coal industry. The undergraduate education of the discipline is mainly based on coal preparation, supplemented by non- coal minerals. At the same time, it gradually expands to the fields of environment engineering, mineral materials and chemical engineering. This major is designed to provide a comprehensive

education and training for students to meet the demand of coal preparation and mineral processing engineering.

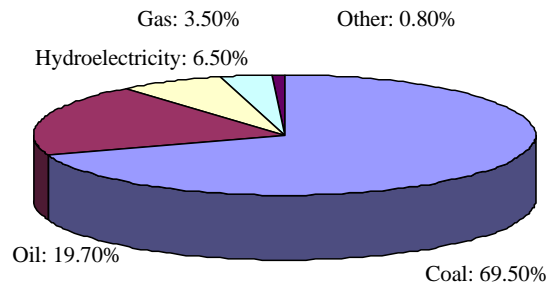


FIG 2 The consumption structure of the primary energy

3. National excellent teaching group

The discipline of mineral processing engineering of CUMT obtains a national excellent teaching group in 2008, which is Natural Science Foundation of China for Innovative Research Group. As a national key discipline, an innovative teaching group was constructed by the development of the discipline of mineral processing engineering, including 2 academicians of Chinese Academy of Engineering, 15 professors, 11 supervisors of doctoral graduates, 23 supervisors of master graduates, 3 ‘Yangtze River Scholar Prize Program Project’ scholars, 2 owners of ‘National Outstanding Young Scholar Fund’, 1 ‘Cross-century Talented Person’, 1 leader of ‘National Innovation and Research Group’^[2], 1 owner of ‘National Top 100 Outstanding Dissertations for Degree of Doctor’.

As the teachers in charge of a class, professors and supervisors for doctoral graduates are required to take up the teaching task for undergraduates. They play central roles in cultivating innovative students for profession. In order to keep the innovative abilities of the teaching group, the discipline focuses on cultivating young teachers, taking flexible ways to help them grow from all sides and improve the quality of the subject. The education background, age structure and academic title of the specialized faculty are given respectively in FIG 3, FIG 4 and FIG 5.

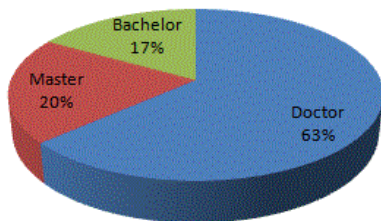


FIG 3 Education background

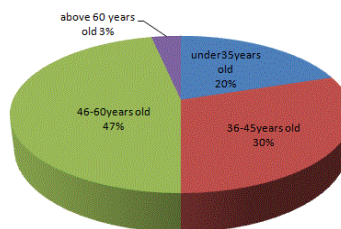


FIG 4 Age structure

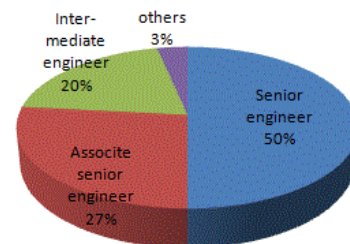


FIG 5 Academic title

The specialized faculty of the discipline obtained many kinds of honors, such as

‘National Young Expert with Prominent Contribution’ owner, ‘Chinese Young of Science and Technology Prize’ owner, ‘National Model Teacher’, ‘Top Ten Outstanding Youths of Jiangsu Province’ owner, ‘Outstanding Educator of Jiangsu Province’, etc. More than fifty times the awards had been gained in various bell-esprit titles above provincial or ministerial-level^[2].

4. Experimental and practical teaching system

Combined with the central courses of the discipline, such as Mineral processing and Methods of coal preparation experimental research, many distinctive experiments are carried out. These experiments are divided into two parts: comprehensive tests and research tests. The comprehensive tests are carried out to show the principles of some equipments of mineral processing or to demonstrate the theories and processing of beneficiations, including coal slime floatability study, coal washability test, waste rock degradation in water test, etc. The research tests, including dense medium processing, jigging processing, flotation column, and dry coal processing test^[4], strength students’ practical operation skills and scientific research abilities.

The discipline has top-ranking researching environment. The area is about 6800 m², and the total property cost of the devices and equipment is approximately 33,260,000 Yuan (RMB). Four sets of typical mineral processing pilot systems are constructed, which include 5~10t/h of dry sieving and air dense medium fluidized bed coal processing system, 5t/h dense medium cyclone desulphurization system, flotation column system, 10t/h jig with control research system^[4-6]. FIG 6 is the pilot system of fluidization bed dry separation and sieving, and FIG 7 is the pilot system of dense medium separation and flotation of fine coal. Both of them are unique pilot experimental teaching systems in the world. Likewise, the laboratory possesses a lot of advanced instruments; including high-speed video cameral system for motion particle analysis, scan electrical mirror, gas chromatography and infrared spectrum apparatus, the determinative instrument of molecular weight, etc.



FIG 6 Pilot systems of fluidization dry coal separation and sieving



FIG 7 Pilot systems of dense medium separation and flotation of fine coal

The laboratory of mineral processing engineering is the key lab of the former Ministry of Coal Industry. The laboratory of 'coal preparation and high-efficiency clean coal utilization' is a key lab of the Ministry of Education.

The discipline of mineral processing engineering of CUMT focuses on engineering abilities training, especially the industrial design ability. Following the course of design and management of coal preparation plant, curriculum design which lasts 2 weeks and graduation design which lasts 18 weeks are taken to strengthen undergraduate students' industrial design ability.

The discipline is a traditional advanced one in CUMT, so its scientific work is active, and it has kept a good cooperating relationship to many coal preparation plants, mines, design institutes and so on. The specialty practice of the discipline of mineral processing engineering is the most important step, and practice teaching part takes up more time. The undergraduate students have three times, the perceptual practice, the productive practice and the graduation practice, to be arranged into the practice teaching bases. They take attendance to experience worker's life and are cultivated with well quality of working with workers. The students could gain sensible knowledge and combine the knowledge from books with the practical work, and confirm the theoretical knowledge via attending many special reports and symposium with the engineers of the plants^[4,7,8].

5. Innovation and reform

5.1 Innovation teaching model

Innovation teaching is indispensable for the training of innovative students. There are several steps for the innovative personal cultivation including theoretic and experimental systems. (1) In classes, we are carrying out an idea of "all procedure innovation education". Under the teaching frame our students accept innovative thoughts and theories in the first year, which is "Innovation experiencing of mineral process". In the next three years, the innovative ideas and examples from research achievements and our faulty in technique development are instructed both in and out of classroom. (2) There are three administrative levels in experiment teaching systems, including experiment of basic method, normative experiment, researching and innovative experiment. (3) The practice teaching systems of production, studying and researching combination college: the supervise committee of specialty teaching, the enterprise practicing and production teaching supervise, the graduation design supervise associate with academes. (4) The extracurricular activities of scientific innovation: the scientific research training program for academic research, the second classroom with supervisors, and the practicing activity in community. The innovative teaching structure was shown in FIG 8.

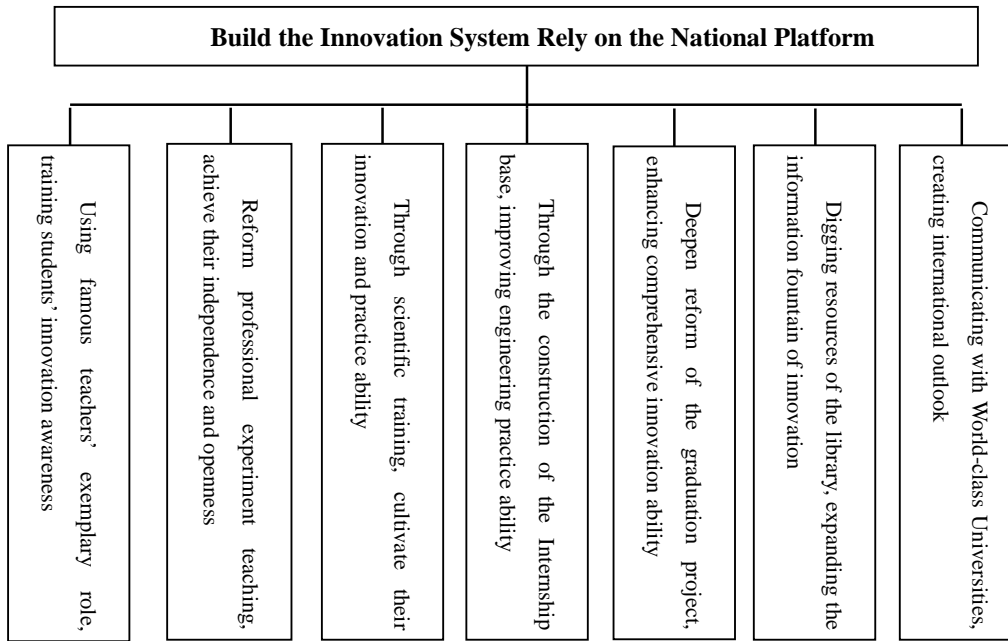


FIG 8 The innovative teaching structure

5.2 Construction and innovation of courses system

<Mineral Processing Theory> is a comprehensive technical disciplines for studying mineral physical separation, sorting, enrichment and comprehensive utilization of mineral resources, and is a core subject of DMPE^[3]. The structure and the outline of the course give superiorities of strengthening foundation and broadening the professional side. In order to train students' abilities of practice and innovation, <Methods of Coal Preparation Experimental Research> and <Concentrator Design> were increased in undergraduate courses, constituting the system of the main professional course of DMPE. Thereinto, <Methods of Coal Preparation Experimental Research> is a kind of experimental course, whose clue is the general process of scientific research. The course introduces the basics of mineral research and theory, experimental techniques and methods for processing experimental data. Through specific laboratory tasks, students' skills of the experiment and abilities of innovation were achieved, and their research capacity and scientific quality were improved preliminarily. <Concentrator Design> is a kind of engineering course for training students' engineering quality and engineering design capabilities. These courses are conducted using the book <Mineral Processing Theory> to train students' awareness of innovation by experiments and engineering design.

For reforming the main courses of the major of mineral processing, a principal was appointed to organize a special team in charge of organizing teaching and curriculum reform^[3]. "Mineral Processing Theory", one of the main courses, was awarded as a provincial excellent course of class A in 2002 and a national excellent course in 2003. "Concentrator Design" and "Methods of Coal Preparation Experimental Research" were both evaluated class one excellent course of Jiangsu Province. Moreover, <Concentrator Design> was also

evaluated Jiangsu provincial competitive course of class two in 2006 and national competitive course in 2009. <Methods of Coal Preparation Experimental Research> is declaring as a national competitive course. So, the system design of the main courses which is accepted by craft brother was proved as a good way to make students meet with the requirement of the times.

5.3 International teaching and academic communications

The discipline of mineral processing engineering pays attention to enhance undergraduate students' global outlook, for bringing up the internationally competitive and innovative characteristics. More and more young teachers are sent to global high-level universities for advanced study and training. In addition, foreign professors are invited to offer some specialized courses. The discipline cooperates with many foreign universities including the University of Duisburg-Essen, the University of Kentucky, the University of Queensland and the University of Dortmund, etc. More than 30 undergraduate and graduate students were associated training with these units. We have sponsored over 10 international or national academic conferences. More than 100 teachers lectured abroad and attended international academic conferences. We also have accepted international and national scholar in advanced studies for more than 40 times^[2].

6. Epilogue

The discipline of mineral processing engineering of CUMT has the certain goal of cultivating students for profession. Associating with the goal, public required teaching, specialty-related base teaching, specialized teaching and practical training are brought out. We not only do our best to enhance undergraduate students' abilities of basic theory and skills, but also attach importance to cultivate their innovative abilities and practical skills. As one of the constructed bases of national feature disciplines, the discipline has substantive achievements in teaching reforms, constructions of the discipline and excellent teaching materials. The construction of undergraduate innovative education is system engineering, steadily teaching reform is necessary for the development. Following the ideas of "Excellent Learning to Use, Excellent Learning to Innovation" of CUMT, The national teaching group explores the innovative teaching reform actively which include professional expansion, prominent teachers education, optimization of the system of major course, engineering practice, specialized core orientation and practical teaching. Correspondingly, the undergraduate education, the construction of teaching faculty and the training of innovative personnel were developed preferably. We will further train the high level international talent with mineral processing for extending the international outlook of teaching faculty. We will continue to cultivating non-coal processing for enlarging the knowledge of undergraduate.

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