

Study on Teaching System of Semiconductor Device Physics under Information Background

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Abstract: At present, semiconductor is a relatively weak industry in our country. It's sustainable and healthy development is related to our county's scientific and technological innovation, economic prosperity as well as national security. Semiconductor device physics, as a very important required course for semiconductor major, has far-reaching influence on the development of semiconductor industry. However, it is dull and difficult to understand especially for the traditional teaching method. Here, some reformation of the teaching methods of semiconductor device physics under information background are put forward. These methods can attract students to participate in class and become masters of learning to some extent.

Keywords: Informatization, Semiconductor device physics, Teaching method.

1. Introduction

As "bottlenecks" industry in our country, semiconductor industry plays an important role in technological innovation, economic prosperity and national security [1, 2]. With the rapid development of artificial intelligence, the Internet of Things and big data, people's demand for semiconductor chips has grown exponentially. The development of civilian consumer electronics, the rapid rise of wearable devices, implantable medical devices, smart mobile terminals, smart home appliances, electric vehicles and other industries has brought huge consumption to power chips, logic chips, memory chips and sensor chips market of our country [3, 4]. The demand of talent and proportion of recruitment in semiconductor industry were shown in Figure 1 (the data are from www.51job.com). With the tension of the relationship, United States has imposed sanctions on our country's semiconductor, defense and military enterprises and other enterprises frequently. In the future, the war will gradually become intelligent and unmanned, and new semiconductor technologies and new materials will also be gradually applied to national defense equipment [5, 6]. However, there is still a big gap between my country's integrated circuit technology and the international advanced level. The key technologies are still controlled by other countries. Vigorously developing the integrated circuit industry and cultivating high-end talents in integrated circuits are the key breakthroughs to solve this problem. Therefore, it is necessary to carry out reforms in the shaping of values, the construction of the curriculum system and the talent training model, break the constraints of traditional thinking and the postgraduate training system [4, 7, 8].

"Semiconductor Devices Physics" is an important professional compulsory course in microelectronics and integrated circuits. It mainly reveals the basic structure, basic principle and working characteristics of important semiconductor devices. It also discusses the motion law of semiconductor device carriers under the action of electric field and the related electrical parameters such as current, voltage and capacitance, which are useful for the study of subsequent courses as well as the foundation of the future work [7-10]. Semiconductor devices physics can cultivate the

ability of using experimental methods to analyze, observe, discover and even research and solve problems [11, 12]. Furthermore, it plays important role in improving the basic quality of the students. However, the traditional teaching method is the most commonly used method in the teaching mode of semiconductor devices physics. Before class, students will preview. During class, teachers simply dictate information and answers. Due to the lack of effective monitoring methods, the preview cannot achieve desired effect. Teachers may spend a lot of time explaining in class. It is difficult to improve the practical ability of students. In addition, the space and time of learning have great limitations, which is not conducive to giving full play to the enthusiasm of students' learning. With the development of Internet technology, college teaching has begun to undergo great changes. The teaching method of semiconductor device physics also faces great challenges. Thus, this paper studies the teaching system of semiconductor device physics based on the informatized background.

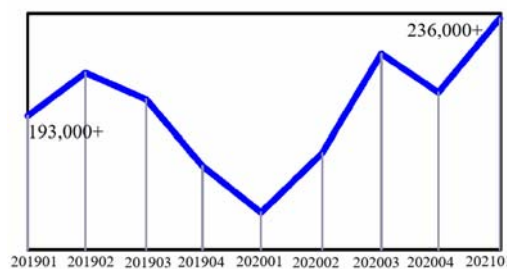


Figure 1(a). The demand for talent in the semiconductor industry

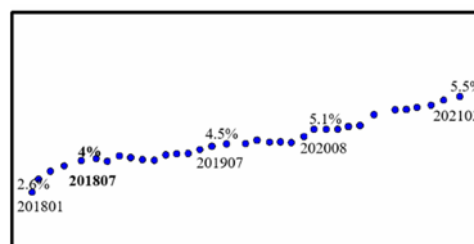


Figure 1(b). The proportion for recruitment for semiconductor industry

2. Problems in Teaching and Ability Training

2.1. Traditional Teaching Methods

Semiconductor device physics usually uses the traditional teaching mode. During the class, teacher will review the content of last lesson first, and then explain the content of the new lesson. Later on, the new lesson is consolidated through exercises and homework is assigned. The traditional classroom model uses a single teaching method and ignores that the classroom subject are students. Since, the semiconductor device physics requires strong theoretical foundation, the traditional teaching mode usually makes students lose interest in learning, which is not conducive to students' mastery of the difficulties in the course.

2.2. Evaluation Mode

At present, the combination of the usual score and the final exam score is mostly used as the assessment method of semiconductor device physics. Thus, the process assessment takes the into account. However, at present, the process assessment mainly refers to the attendance of students and its proportion is relatively low. The assessment method of "one examination determines the result" has not changed fundamentally. This method focuses on results rather than process, and makes it difficult for students to participate in class.

3. Improvement Measures

3.1. Reformation of Classroom Management

Teachers should break the rigid classroom and indoctrination-based teaching method. The teaching methods that make full use of modern information technology such as online and offline integrated teaching, flipped classroom, five-star teaching, BOPPPS, TBL (team-based teaching method), PBL (problem-based teaching method) should be encouraged. During class, teachers should use the heuristic teaching, interactive communication, exploratory discussion mode, thus teaching benefits teachers as well as students.

3.2. Reformation Assessment Method

The proportion of process assessment should be increased. Classroom performance, in-class tests, knowledge tests, thematic papers, research reports and other forms of activities in class could effectively attract students to participate in class actively. Furthermore, teaching modes, as the most effective measures, could reflect the principle of "learner-centered" in the classroom teaching. "Non-standard answer" examination method should also be carried out. According to the curriculum content and the needs of teaching, the combination of standard answers and non-standard answers could be adopted to carry out the assessment. Teachers should explore "non-standard answer" assessment method of open proposition and creative examination through innovative short essay, open topic and case analysis focusing on students' ability to analyze and solve problems with knowledge, guiding students to study independently. The deep-rooted problem of "high scores and low abilities" should be eliminated.

3.3. Reformation of the Teachinl

At present, there is a great variety of semiconductor devices, and the technology changes rapidly. However, the revision

speed of culture system can not keep up with the development of technology and industry. As the semiconductor device sizes decrease nanometer scale, MOSFET devices are increasingly restricted by short channel effect, leakage current and subthreshold swing. Researchers have proposed a series of semiconductor devices based on new principles, new structures or new materials [1, 2]. However, the teaching material construction of device physics lags far behind the development of technology. In the teaching of semiconductor device physics, teachers should optimize the teaching content and curriculum system, and develop loose-leaf textbooks to integrate cutting-edge achievements and practical cases into classroom teaching in a timely manner. According to the characteristics of different students, teachers are encouraged to choose different teaching content to carry out teaching, and strive to provide personalized teaching services for students. In addition, semiconductor industry is a demand-driven field, many companies require graduates with some work experience. Universities should explore the mechanism of joint training semiconductor enterprises and open up channels of talent training and communication. Thus, the training of semiconductor-related personnel will be accelerated, the gap in industrial development will be bridged.

4. Summary

In conclusion, we discussed some obvious problems in semiconductor device physics teaching. Considering the related problems, some improvement measures are put forward under the current information background. students are expected to actively participate in the classroom, stimulate students' interest in learning, make students become the main body of learning, learn the semiconductor device physics related knowledge, and can effectively apply the knowledge learned.

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