

# 广东以色列理工学院材料科学与工程专业人才培养方案

(专业代码: 080401H)

## 一、概述

本专业以物理、化学和工程学为基础,旨在让学生了解加工和构成如何影响材料的结构、性质和性能,是多学科知识与技能的交叉融合。专业课程涵盖了晶体结构和微观结构分析、材料加工、电化学、扩散和相变、动力学和热力学、高分子性质等内容,旨在培养能够整合与领导材料研发及在半导体制造、生物材料等高科技产业应用的优秀工程师和科技人才。

## 二、培养目标

学生将参与多项与产业界合作的研发项目,掌握材料科学与工程的先进研究方法。本专业毕业生可从事学术研究(以研究生深造的方式)或在相关行业就业。材料工程师可在以下应用领域的行业及开发中心求职:电子和通信;航空航天或飞行器制造;核电行业;高分子纳米复合材料及塑料材料;以及制药和生物材料。

## 三、毕业学分要求

四年制本科专业总学分为160学分,含2个学分的体育课。学生还需修满教育部规定的思想政治理论课程学分,并达到考核合格标准。教学既包括理论教学,也包括实践教学。

## 四、修业年限

四年,授予广东以色列理工学院材料科学与工程专业工学学士学位,以色列理工学院 Materials Engineering 学士学位。

## 五、人才培养基本要求

1. 掌握本专业工作所要求的数学、自然科学知识、工程技术知识以及一定的经济学与管理学知识。
2. 系统掌握材料科学与工程学科的基本理论和知识;熟悉材料组成、结构、合成/生产与性能之间关系的基本原理。
3. 掌握本学科涉及的各种材料的制备、性能测试和分析的基本知识和技能。
4. 了解材料相关学科的发展现状和趋势;有创新意识;具有提高材料性能和产品质量,开发和研究新材料和新工艺,根据工程项目选择和使用材料等基本能力。

5. 培养创新和创业的技能。
6. 具有终身学习的意识；能够运用现代信息技术获取相关信息、新技术、新知识，不断提高个人能力。
7. 具有全球视野，高水平的外语能力，跨文化交际能力和合作能力。

## 六、毕业要求

本专业学生在规定年限内完成教学计划要求，取得不少于规定的 160 学分（包括专业核心课程 126 学分，专业选修课程 24 学分以及通识选修课程 10 学分），并且每门课程达到 55 分以上，GPA 达 65 分以上，满足教育部规定的思想政治理论课的学分要求，可经审核准予毕业。

## 七、基本信息资源

以手册、网站等形式，提供本专业的培养方案、教学大纲、教学标准、课程评价标准、毕业审核标准等基本教学信息。

## 八、教材及参考书

选用反映国际水平的外文版教材，有利于稳妥地开展双语或全外语教学。

## 材料科学与工程专业课程目录<sup>1</sup>

专业必修课	126 分
专业选修课	24 分
通识选修课	10 分
<b>总分</b>	<b>160 分</b>

课程代码	课程名称（专业核心课程）	学分
<b>第一学期</b>		
104041	微积分 1M	5
104019	线性代数 M	4.5
114051	物理学 1	2.5
124117	基础化学 A	3
234128	Python 计算机入门	4
324033	专业英语 B	3
<b>总学分</b>		<b>22</b>
<b>第二学期</b>		
104043	微积分 2 M	5
104131	常微分方程/H	2.5
114052	物理学 2	3.5
124118	基础化学 B	3
314011	工程材料结构与性能	4
394800	体育	1
<b>总学分</b>		<b>19</b>
<b>第三学期</b>		
094481	概率论与数理统计导论	4
104228	偏微分方程 M	3
114081	物理实验 1	1.5
124400	量子化学（一）	5
314009	工程材料实验	1.5
<b>总学分</b>		<b>15</b>
<b>第四学期</b>		
125801	有机化学	2.5
124413	统计热力学	2.5
124414	物理化学-化学反应动力学	2.5
314009	工程材料实验 N	1.5
314003	固体力学导论	2.5
315003	材料热力学	4

1. 开设课程与学期根据以色列理工学院教学计划与实际教学安排可能进行动态调整。

315051	固态扩散	2.5
394800	体育	1
<b>总学分</b>		<b>19</b>
<b>第五学期</b>		
314006	材料的显微结构表征	4
314150	固态物理	3.5
314312	聚合物材料导论	2.5
314532	电化学、腐蚀与防腐蚀	2.5
315052	相变动力学	2.5
315242	复合材料工程	2.5
<b>总学分</b>		<b>17.5</b>
<b>第六学期</b>		
314016	计算机辅助材料工程图形	2.5
314311	陶瓷与耐火材料	2.5
315008	材料力学	3.5
315030	电子材料	2.5
315039	动量、热与物质传送	4
315058	计算机分析方法	2
<b>总学分</b>		<b>17</b>
<b>第七学期</b>		
314309	材料加工	2.5
315001	高级材料实验 1N	2
315012	材料选择	2.5
315037	金属材料的性能与应用	2.5
315059	功能材料：性能与器件	2.5
<b>总学分</b>		<b>12</b>
<b>第八学期</b>		
315002	高级材料实验 2N	2
315014	材料工程高级项目（毕业设计/论文）	4
<b>总学分</b>		<b>6</b>

**选修课程：**学生应该至少从以下两个列表课程中获得 25 学分

材料科学与工程专业选修课程列表		
课程代码	课程名称	学分
314124	材料工程前沿课题 1	2.5
314126	材料工程前沿课题 2：导电式原子力显微镜	2
314306	激光材料加工	2.5
315016	半导体器件	2.5
315017	加工制作和电解涂层	2.5

315018	生物材料	2
315021	粉末冶金与技术	2.5
315025	材料工程高级项目	3
315027	微电子器件的可靠性	2.5
315031	电子陶瓷	2.5
315034	先进陶瓷制备工艺	2
315035	材料工程项目-选修	3
315038	微电子材料机械系统	2.5
315040	玻璃科学导论	2
315041	材料光学现象	2.5
315042	纳米科学与技术导论	2
315044	光学材料	2.5
315045	微电子工艺加工	3.5
315046	超大规模集成电路器件的封装	2
315048	生物矿化和生物材料	2
315050	聚合物粘合剂和接头的科学与工程	2.5
315053	用于药物输送的高分子生物材料工程	2.5
315054	故障分析及其预防	2
315056	晶体生长	2.5
315057	计算材料学/计算材料科学导论	2.5
315721	聚合物结构与性能	2.5
316240	晶体学基础	2
316541	导电原子力显微镜	2
317531	计算机在材料工程中的应用	2
317627	微电子器件的触点和金属化	2
316243	中子和同步加速器测量仪器	2
316244	薄膜的磁性	2
318221	表面分析	2
318222	离子辅助表面分析	2
318235	塑料型变理论	2
318527	衍射的动力学理论	2

其他院系专业选修课程列表		
课程代码	课程名称	学分
054131	化学与生物化学工程概论	4
054369	高分子材料工程实验室	2.5
056391	基于纳米（生物）材料的传感器	2.5
124122	化学原理实验室	1
124416	电磁学和物质	2.5

124417	物理化学-分子光谱学	3.5
125101	工程分析化学 1	1.5
125102	化学工程分析化学实验课 1	2
127437	光催化	2
127438	对称性及其在化学中的应用	4
134058	生物学 1	3
858121	聚合物流变学	2

## **GTIIT Cultivation Scheme of Materials Science and Engineering Program**

### **1. Overview**

Based on physics, chemistry and engineering, the program aims to let students understand how processing and composition affect the structure, properties and performance of materials, and is a combination of multidisciplinary knowledge and skills. Specialized courses cover crystal structure and microstructure analysis, materials processing, electrochemistry, diffusion and phase transitions, kinetics and thermodynamics, and polymer properties, aiming to produce outstanding engineers and technologists who can integrate and lead materials research and development and its application in high-tech industries such as semiconductor manufacturing and biomaterials.

### **2. Cultivation Goal**

Students will participate in R&D projects many of which are in cooperation with the industry, and master advanced research methods of materials science and engineering. Graduates of the program can be engaged in academic research (mainly by advancing to graduate studies) or get employed in relevant industries. Material engineers may seek employment in industries and development centers of the following applications: electronics and communication; aerospace or vehicle manufacturing; nuclear industry; polymer nanocomposites and plastic materials; and in pharmaceuticals and biomaterials.

### **3. Total Credits for Graduation**

The total credits of the four-year undergraduate program are 160, including 2 credits of physical education courses. Students are also required to complete the credits in ideological and political theory courses as stipulated by the Ministry of Education of China (MOE) and meet the passing assessment standards. The teaching includes theoretical teaching as well as practical teaching.

### **4. Study Years**

4 years, students will be awarded the bachelor's degree of Engineering in Materials Science and Engineering of GTIIT, and the bachelor's degree of Science in Materials Engineering from the Technion.

### **5. Basic Requirements for Talents Cultivation**

- a. Master the knowledge of mathematics and natural science, the knowledge of engineering technology, and certain knowledge of economics and management required by the professions in this program field.

- b. Systematically master the basic theories and knowledge of the materials science and engineering discipline; familiar with the basic principles of the relationship between materials' composition, structure, synthesis/production and properties.
- c. Master the basic knowledge and skills of preparation, performance testing and analysis of various materials involved in the discipline.
- d. Understand the development status and trends of related disciplines in materials; have a sense of innovation; have basic abilities to improve materials performance and product quality, to develop and study new materials and new crafts, to select and use materials according to engineering projects, etc.
- e. Develop the skill of innovation and entrepreneurship.
- f. Have a sense of lifelong learning; able to use modern information technology to acquire related information, new technologies, and new knowledge to constantly improve personal abilities.
- g. Have a global vision, high-level foreign language proficiency, intercultural communications ability and cooperation ability.

## **6. Graduation Requirements**

Students will graduate when fulfilling the graduation requirements within the prescribed number of years, and have at least 160 credits of the described structure of core (126 credits), program elective (24 credits) and general e courses (10 credits), with a minimum grade of 55 in each course, and GPA above 65. Fulfilling the requirement of MOE ideological and political theory courses, students may be approved for graduation upon review.

## **7. Basic Information Resources**

The program cultivation schemes, syllabi, teaching criteria, assessment criteria of courses, graduation evaluation criteria and other basic teaching information are offered in form of brochures, websites, etc.

## **8. Textbooks and References**

Foreign language textbooks that reflect the international level are selected for steady practices of bilingual or fully English-medium instruction.

## Materials Science and Engineering Program Curriculum<sup>2</sup>

Compulsory Courses	125 points
Program Elective Courses	25 points
General Elective Courses	10 points
<b>TOTAL</b>	<b>160 points</b>

Course Code	Course Name (Program Core Course)	Credits
<b>Semester 1</b>		
104041	Differential and Integral Calculus 1M	5
104019	Linear Algebra M	4.5
114051	Physics 1	2.5
124117	Principles of Chemistry A	3
234128	Introduction to Computing with Python	4
324033	Technical English - Advanced B	3
<b>Total</b>		<b>22</b>
<b>Semester 2</b>		
104043	Differential and Integral Calculus 2 M	5
104131	Ordinary Differential Equations/H	2.5
114052	Physics 2	3.5
124118	Principles of Chemistry B	3
314011	Structure and Properties of Engineering Materials	4
394800	Physical Education Courses	1
<b>Total</b>		<b>19</b>
<b>Semester 3</b>		
094481	Introduction to Probability and Statistics	4
104228	Partial Differential Equations/M	3
114081	Physics Lab. 1	1.5
124400	Quantum Chemistry 1	5
314009	Engineering Materials Laboratory N	1.5
<b>Total</b>		<b>15</b>
<b>Semester 4</b>		
125801	Statistical Thermodynamics	2.5
124413	Physical Chemistry - Chemical Kinetics	2.5
124414	Organic Chemistry 1b*	2.5
314009	Introduction to Solid Mechanics	1.5
314003	Thermodynamics of Materials	2.5
315003	Diffusion in Solids	4

2. Course offerings and scheduling may be properly adjusted in accordance with the Technion's academic plan and actual teaching arrangements.

315051	Physical Education Courses	2.5
394800	Statistical Thermodynamics	1
<b>Total</b>		<b>19</b>
<b>Semester 5</b>		
314006	Microstructural Characterization of Materials	4
314150	Solid State Physics	3.5
314312	Introduction to Polymeric Materials	2.5
314532	Electrochemistry, Corrosion & Corrosion Protection	2.5
315052	Kinetics of Phase Transformations	2.5
315242	Composite Materials Engineering	2.5
<b>Total</b>		<b>17.5</b>
<b>Semester 6</b>		
314016	Computer-aided Material Eng. Graphic	2.5
314311	Ceramics and Refractories	2.5
315008	Mechanical Behavior of Materials	3.5
315030	Properties of Electronic Materials	2.5
315039	Momentum, Heat and Mass Transport	4
315058	Computer Analysis Methods	2
<b>Total</b>		<b>17</b>
<b>Semester 7</b>		
314309	Materials Processing	2.5
315001	Advanced Materials Laboratory 1N	2
315012	Materials Selection	2.5
315037	Properties and Applications of Metals	2.5
315059	Functional Materials - Properties & Devices	2.5
<b>Total</b>		<b>12</b>
<b>Semester 8</b>		
315002	Advanced Materials Laboratory 2N	2
315014	Advanced Project in Materials Engineering	4
<b>Total</b>		<b>6</b>

The student should acquire at least 25 points taking elective courses from the two lists given below:

<b>Electives Courses from Materials Science and Engineering Department</b>		
<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
314124	Advanced Topics in Materials Engineering 1	2.5
314126	Advanced Topics in Materials Engineering 2 - Conductive Atomic Force Microscopy	2
314306	Laser Material Processes	2.5

315016	Semiconductor Devices for Materials Engineering	2.5
315017	Finishing Processes and Electrolytic Coating	2.5
315018	Biomaterials	2
315021	Powder Metallurgy and Technology	2.5
315025	Advanced Project in Materials Engineering 2	3
315027	Reliability of Microelectronic Devices	2.5
315031	Electronic Ceramics	2.5
315034	Processing of Advanced Ceramics	2
315035	Materials Engineering Project - Optional	3
315038	Materials for Micro-Electro-Mechanical-Systems	2.5
315040	Introduction to Glass Science	2
315041	Optical Phenomena in Materials	2.5
315042	Introduction to Nanoscience and Nanotechnology	2
315044	Optical Materials	2.5
315045	Processes in Microelectronics Fabrication	3.5
315046	Packaging of VLSI Devices	2
315048	Biomineralization and Biological Materials	2
315050	The Science and Engineering of Polymers Adhesives and Joints	2.5
315053	Engineering of Polymeric Biomaterials for Drug Delivery	2.5
315054	Failure Analysis and its Prevention	2
315056	Crystal Growth	2.5
315057	Computational Materials Science	2.5
315721	Fracture and Behavior of Polymers	2.5
316240	Basics of Crystallography	2
316541	Conductive Atomic Force Microscopy	2
317531	Computer Applications in Materials Engineering	2
317627	Contacts and Metallization for Microelectronic Devices	2
316243	Neutron and Synchrotron Instrumentation	2
316244	Magnetic Properties of Thin Films	2
318221	Surface Analysis	2
318222	Ion Assisted Surface Analysis	2
318235	The Theory of Plastic Deformation	2
318527	The Dynamical Theory of Diffraction	2

<b>Electives Courses from Other Departments</b>		
<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
054131	Introduction to Chemical and Biochemical Engineering	4

054369	Polymer Engineering Laboratory	2.5
056391	Sensors based on Nano (Bio) Materials	2.5
124122	Laboratory in Principles of Chemistry	1
124416	Electromagnetism and Matter	2.5
124417	Physical Chemistry -Molecular Spectroscopy	3.5
125101	Analytical Chemistry 1 for Engineers	1.5
125102	Analytical Chemistry Laboratory1 For Engineers	2
127437	Photocatalysis	2
127438	Symmetry and its Applications in Chemistry	4
134058	Biology 1	3
858121	Polymer Rheology	2