

SHANGHAI INSTITUTE OF METALLURGY -- FACING THE WORLD

L. He and L.P. Fu

Shanghai Institute of Metallurgy, Chinese Academy of Sciences,
865 Changning Road, Shanghai 200050, China

ABSTRACT

Shanghai Institute of Metallurgy (SIM), Chinese Academy of Sciences is a multioriented applied science research institution that was founded in 1928. The current principal research activities of SIM cover three areas, namely, microelectronics, functional materials and devices, corrosion and protection of metals. The general information of SIM, includes history, personnel, organization, etc., is provided. The main research laboratories and R&D themes are introduced also. SIM has made great contributions to the economic construction and development of science and technology of the nation. China is facing a golden opportunity for development and SIM is playing an important role in translating research results into large-scale, commercial productions. Several successful examples are shown. SIM has been active in promoting international collaboration in research and development. The international cooperative projects in SIM are reviewed. SIM is facing the world, and going toward the 21st century.

1. GENERAL INFORMATION OF SIM

SIM was founded in 1928. Its predecessor is the National Research Institute of Engineering. Three institutes were splitted from SIM: Changsha Institute of Mining and Metallurgy (1956), Kunming Institute of Noble Metals (1959) and Shanghai Institute of Ceramics (1960). SIM is a multioriented applied science research institution. Its principal research activities in 1950's include:blast furnace smelting process of iron ores containing rare-earth (Baotou), vanadium-titanium magnetite (Panzhihua), low alloy steels and powder metallurgy products. Since the early 1960's, the main efforts have gradually been shifted to the study on ultrapure metals, semiconductor materials and devices, integrated circuits, magnetic and superconducting materials, corrosion and protection of metals and ion beam technology and its applications. The current principal research activities cover three areas, namely, microelectronics, functional materials and devices, corrosion and protection of metals.

SIM has 1000 employees, among them 600 are scientists (50 professors), 70 administrative staffs, 150 doing manufacturing and management, 180 for technical support and other services.

SIM has made great contributions to the economic construction and development of science and technology in China. Among the 665 achievements successfully obtained in research work over the past forty-five years, 312 won prizes. In the recent years, SIM published about 300 original papers annually.

SIM can award Ph.D. degree in four areas: physics of semiconductors and semiconductor devices, material physics, corrosion and protection, physical chemistry of metallurgical process and 9 areas for Master degree. 100 graduate students are being kept constantly.

2. KEY LABORATORIES

----research on the basic theories and technologies

- State Key Laboratory of Transducer Technology
main research projects:
Microstructure materials
Micromachining technology
Micro-electromechanical systems
Biological transducers and related technology
- State Key Laboratory of Functional Materials for Informatics
main research projects:
Semiconductor superlattice materials
Laser, electron and Ion-beam Synthesis of thin films
Structure and physical properties of thin films for optical storage
Influence of the structure and defects on the properties of sensitive materials
Theory of electromagnetic and optic properties of thin films
- Ion Beam Laboratory
main research projects:
Ion implantation of semiconductors
Ion beam surface modification of materials
Ion beam micro-fabrication
Ion beam synthesis of films
Ion Beam surface layer analysis
Fundamental studies on ion beam-solid interactions
- SIM Daimler-Benz LAB
main research projects:
Advanced packaging materials and technologies for power integrated circuits and components. Comprise investigation on metallization on chip level, interconnection, passivation and encapsulation technologies, and relevant testing procedures and computer simulation.

3. OTHER DEPARTMENTS

Physics and Chemistry of Materials
Compound Semiconductor Materials and Devices
Magnetic Materials and Devices
Superconductor and Metallic Materials
Corrosion and Protection of Metals

4. TECHNICAL SERVICE SYSTEM

Analytical Chemistry
Physical Characterization of Materials
Electronic Instrumentation

Workshop of electro-machinery

5. ENGINEERING RESEARCH CENTER

---medium base for quickly translating technological achievements into the industrial productivity

- State Engineering Research Center for Shanghai Microelectronics
main R&D projects:
2um CMOS, BICMOS, ECL technology
Application specific Ics (ASICs)
CMOS gate array
0.5-1.5um IC and devices
Computer aided design and mask fabrication
- State Engineering Research Center for Optical Disks and Application
main R&D projects:
Technology of manufacturing optical disks
Application of optical disks
- National Engineering Research Center for Metallic Thin Film Functional Materials & Devices
main R&D projects:
Materials and novel deposition technology of metallic film and fine processing technology of the related devices

6. CORPORATIONS AND CAMPUSES

---hi-tech industries

- Headquarters
Shanghai SIM New Technology Corporation
- Caohejing Branch
Dupont Photomasks Co. Ltd. Shanghai
Pach Opto-Electronic Devices Co. Ltd.
- Jiading Branch
Shanghai Simconix Electronic Co. Ltd.
Shanghai Simedia Magneto-Electronic Co. Ltd.

7. INTERNATIONAL EXCHANGES AND COLLABORATIONS

- Extensive and Frequent International Exchanges and Collaborations
SIM has set up relationship of the collaboration with the research institutions in UK, Germany, France, Australia, USA, Brazil, Russia, Japan, Singapore and Korea. It is proved that a formal link between two research groups based on goodwill and mutual benefits is the assurance of a long term collaboration and the achievement of significant results.
- Varied Forms of International Exchanges and Collaborations:
 - exchange of technical informations and samples
 - exchange of scientists including students
 - joint utilization of scientific laboratories, facilities and equipments
 - joint organization of expert meetings or training courses
 - joint research project

- contract R&D project
- joint research laboratory
- joint venture company

- From Joint venture to research collaboration with Daimler-Benz
 - a successful experiment

The cooperation between SIM and DB can be traced back to 1992, when SIM and SILICONIX, a subsidiary of the TEMIC Microelectronic Co, start negotiation to establish a joint venture company for packaging and testing of little foot power IC—SOIC8. SIMCONIX started its production in December 1993, six months after signature of the contract, and reached its targeted production volume of 3 million devices per month and over all yield of 97.8 percent in April 1994. In June 1994 SIMCONIX passed IBM audit and obtained certification for approval. After the expansion of the production volume from 3 to 7.5 million devices per month from the beginning of this year SIMCONIX become one of the main supplier of little foot power SOIC in the world.

The success of SIMCONIX led to the establishment of a joint research laboratory in the headquarter of SIM with Daimler-Benz (DB) Research center. On January 1, 1995 the scientists from SIM started work at the joint laboratory in the field of advanced packaging materials and technologies for power integrated circuits and components. This work is initially scheduled to run over a period of five years. The research project, approved by the Steering Committee consisting three members from SIM and three members from DB, comprises investigation on metallization on chip level, interconnection, passivation and encapsulation technologies, and relevant testing procedures and computer simulation. The scientists work not only in Shanghai, but also with their German colleagues at DB research laboratory in Frankfurt. Also, DB scientists will be dispatched to work with the Chinese colleagues at the joint laboratory. The main technical equipment required for the laboratory is supplied by DB and the operating costs of the laboratory are covered by SIM. The technology developed in this laboratory will be transferred to not only SIMCONIX but also other companies doing packaging.

SIM is facing the world, and going toward the 21st century.