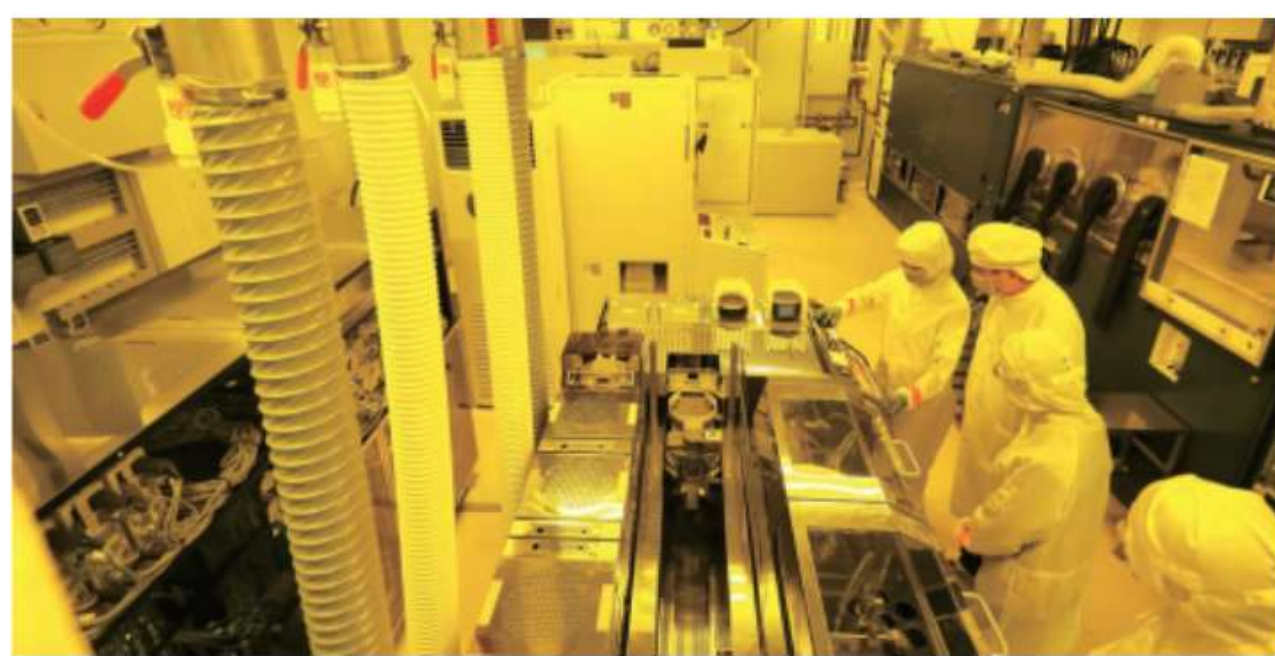


Meeting the rise of 5G, EV, and future high speed and low power consumption logic applications

Compound Semiconductor Device Research Center (CSD Research Lab) at NYCU is dedicated to the development of world class III-V electronics technologies for academic excellency as well as to support the III-V community with the frontier technologies for industrial applications. As the global leader in the semiconductor industry, Taiwan must actively invest in the development of its innovative technologies to maintain the competitive advantages. CSD Lab will serve as a research platform for the integrated III-V technology for Taiwanese industry from materials, devices, processes, equipments, package, and testing up to pilot line production.

CSD is the only university laboratory worldwide that provides 3 – 6 inch III-V MMIC fabrication service with process capability down to 60-nm. The Lab provides the GaAs and GaN foundry services to offer unique solutions for III-V MMIC and III-V/Si integration for future high frequency communication and terahertz imaging applications, and GaN based high power high frequency devices for 5G and EV applications. CSD Research Lab cooperates closely not only with the industry through the execution of industry – university cooperative research projects but also with the international research institutions through innovative, pioneer joint research projects.



In 2010, the research team from NYCU led by Prof. Edward Yi Chang have successfully developed the world's highest cut-off frequency (ft) of 710 GHz InAs high electron mobility transistors (HEMTs). The output performance of the world-class high frequency InAs HEMTs has reached terahertz (THz) band. It is potential for the future submillimeter-wave applications such as space telemetry, imaging radar, and biomedical detection.

From 2013 – 2017, the center in NYCU started a research project “International Center of Excellence in Advanced Heterogeneous Integration of Green Electronics Research – iRICE” funded by the Ministry of Science and Technology in Taiwan. It aimed at developing advanced semiconductor-related technologies for the post – Silicon and More – Moore era technology demands in the future. To enhance the global competitiveness, this center was established between the NYCU – Taiwan and UC Berkeley EECS – USA, based on their long-term solid foundations of research and strength in the semiconductor field. The goal was to establish a world-class nanoelectronics research center in Taiwan. In addition, companies such as TSMC, Applied Materials, Integris, and Panasonic have joined and co-sponsored the research activities.



Since 2018, the Center for Semiconductor Technology Research has been established at NYCU to integrate the cross-disciplinary talents of National Yang Ming Chiao Tung University, combined with the Taiwan Semiconductor Research Institute and the Synchrotron Radiation Center, closely cooperated with TSMC to jointly solve the technical bottlenecks facing the extreme scaling of semiconductor devices. The research topics are divided into five major topics, namely monolithic stacked devices and circuits, negative capacitance transistor technology, two-dimensional semiconductor devices and materials, low-impedance interconnect and contact resistance technology, and III-V based transistor technology for high speed and high frequency applications. In this program, CSD Lab will develop InGaAs FinFET for high frequency applications with high cut-off frequency ft up to terahertz to meet future IoT and 5G with high-bandwidth communication applications. In addition, an integrated process of GaN drain FinFETs is under development targeting at high frequency FinFET with high breakdown voltage.

Another project in progress for CSD Lab is to develop a lighter, longer-distance, faster and safer LiDAR for EV application. This project is in cooperation with Foxconn corporation, to develop LiDAR system with high reliability and low cost for self-driving cars. In order to achieve the targets of longer range and faster plan, the team intends to develop a new high frequency, high current gallium nitride high electron mobility transistors (GaN HEMTs) laser drive to integrate with the aforementioned new surface emitting laser chip using flip-chip technique into a new LiDAR laser light source chip assembly. By using GaN HEMTs to generate high current and high speed pulses, the LiDAR can achieve higher resolution and longer distance. The ultra-small size of GaN HEMT also make it the best driving element for lightweight LiDAR applications. In this research project, CSD team will demonstrate a high-quality beam with a narrow exit angle. This LiDAR light source chipset can also be used in optical digital instruments and electronic optical switches developing by CSD – NYCU to integrate optical, electronic and mechanical components to ensure good optical and electronic characteristics to meet the needs of extremely light, longer distance, and more fast and safer requirements.

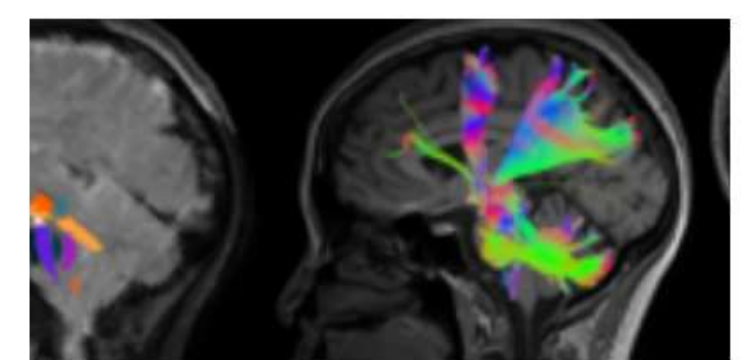
Prof. Edward Yi Chang has been very active in cooperating with international leading institutes, the cooperation partners include labs from UC Berkeley (USA), Virginia Tech (USA), MIT (USA), TIT (Japan), NTT (Japan), IMEC (Belgium), and Chalmers University (Sweden). The results have been disseminated in the form of high quality publications. The important findings from these collaborations have resulted in successful technology transfer, which acts as another driving force for developing advanced III-V semiconductor devices in the 5G/6G and EV application. CSD Research Lab is very well equipped with all the necessary tools for III-V hetero-structure product development and has very good relationship and records with government agencies and industrial partners through successful product development and technology transfers. The researchers in CSD Research Lab look forward to continued co-operation with pioneer semiconductor industries and top universities around the world.



More Research Highlights



From Bioelectronics to Nano-bioelectronics: NYCU Biomedical Electronics Translational Research Center



NYCU brain research facilitates interdisciplinary approaches to uncover the mystery of brain functions



Cancer research at NYCU offers novel therapeutic strategies from tumorigenesis to metastasis



Tunable Ultra-low Threshold Bound State in the Continuum Lasers Discovered through NYCU-Russian Collaboration



NYCU Researchers Find Polymeric Nanomaterials under Nanoconfinement for the Development of Light-Responsive Electronics

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