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# LULI DOID DODO ANARDS

FACING SUSTAINABILITY IN THE LAB PROGRAMS IDENTIFY ENVIRONMENTAL OFFENDERS IN THE QUEST FOR GREEN LABORATORIES.

SILICON VALLEY'S R&D TRIPLE PLAY Mixed Partnerships involve industry, government labs and academia for a winning formula.



#### The Low-Dose 3D X-ray Imaging System-Taiwan TomoDR

Taiwan TomoDR is a 3D digital tomosynthesis(DT) imaging system that is superior to conventional DT machines and can provide CT(computed tomography)-like images at low exposure doses. TomoDR has an innovative multi-directional scanning function, such as head(H)-to-foot(F) and left(L)-right(R) directions, and can collect X-ray projections from each scanning direction for image reconstruction, which retains more image information and improves image quality compared with conventional DT machines. The mechanism design allows for easy switching between supine/standing 3D imaging modes according to different needs. Clinical trials for vertebral compression fracture diagnosis have shown that TomoDR can significantly increase the clinical information available to the physicians during interpretation and improve the accuracy of diagnosis. In a simple and quick workflow, and at a low exposure dose. TomoDR offers high-quality multi-slice images to visualize the part invisible for conventional 2D X-ray images.



### Low-Cost Electrochromic Energy-Saving Window

The Institute of Nuclear Energy Research (INER) has successfully established a rapid deposition machine for producing electrochromic glass. The machine equipped with a unique high-density plasma deposition system and was able to steadily mass-produce electrochromic glass with high transmittance. Although the cost of the machine is only 1/3 of that of a traditional magnetron sputtering system, its deposition rate is increased by 4 times. On April 9, 2021, Licon and INER signed the "Technologies of large-area electrochromic film deposited by high-density plasma" licensing agreement, with a contract value of NT\$16 million. With the cooperation and efforts of INER and Licon, the production and distribution speeds of electrochromic products in Taiwan can be accelerated, and the related products can enter the global market. It is a new chapter of the energy efficient technology in Taiwan and can contribute to achieving the goals of "green economy" and "environmental sustainability" Taiwan's energy policy.



Electrochromic windows (20 × 30 cm<sup>2</sup>). Left: un-tinted glass. Right: tinted glass. The percentage of variation rate of visible light is 50 %.

## Novel Hexa-Lactoside Derivative as Positron Emission Tomography (PET) Imaging Agent for Liver Receptor with Ga-68

Competent residual liver function is crucial to patients' survival from liver diseases. As a significant difference exists between the number of asialoglycoprotein receptors on the parenchymal cell membrane of a normal liver and a diseased liver, asialoglycoprotein receptor imaging can be used to differentiate normal and diseased livers sensitively. INER Dolacga Kit as a tool for evaluation of liver reserve has proven in a phase I clinical trial to be highly liver-targeting and safe, and is expected to provide more accurate evaluation of residual liver function than most existing imaging technologies and replace them. INER Dolacga kit has world-wide patent map and has been developed to give lyophilized formulation that can be used for PET imaging after simple and fast (15 min) Ga-68 labeling. The labeled product specifically targets to liver receptors with high sensitivity and low background level. Convenient and rapid labeling (15 minutes), short half-life of Ga-68 (environmentally friendly), and stable (favorable to global distribution) are the key features and are advantageous to product commercialization.



#### Hundred-kW-scale Microgrid System

INER established the first hundred-kW-scale microgrid demo site in Taiwan, which is connected to high-volt feeder of Taiwan Power Company (TPC). This microgrid can receive the instructions from TPC to execute power dispatch, such as load shedding, grid disconnection, and grid connection. While connected to the main grid, the microgrid can steadily export power of 100kW, and keep providing 4-hour auxiliary services. Under grid-disconnected (islanded) mode, the average power generated by the renewable energies accounts for 54%, while the microgrid can still operate steadily by the Energy Management System (EMS), which serves as a base for development of technologies of regional grid with high penetration renewable energies in the future.



## Technologies for Solid-State Lithium-Ion Batteries

In the development of solid-state lithium-ion battery, INER has developed a roll-to-roll production technology of polymer electrolyte films and an atmospheric plasma spraying (APS) technology of high areal capacity cathodes for future solid-state lithium-ion battery applications. A high safety, high-capacity, and cost-effective polymer electrolyte lithium-ion battery has successfully demonstrated a 3.8 Ah capacity with a LiNi0.6C00.1Mn 0.1O2 (NCM811) cathode and a graphite anode. Furthermore, high deposition rate of the high areal capacity APS cathode has also been achieved with a deposition rate of 5,400 nm/min. After assembling a solid-state lithium battery, the APS cathode has demonstrated a high areal capacity of 6.09 mAh/cm<sup>2</sup> on a single side substrate, which is also the best areal capacity performance to date. We believe these technologies are the possible candidates for the future production of solid-state lithium-ion batteries.



#### Solution Printing Process Technology for Flexible and Transparent Polymer Solar Cell Modules

The Institute of Nuclear Energy Research (INER) has pioneered a roll-to-roll continuous coating process for the mass production of the large-area flexible semitransparent polymer solar cells (PSCs), which overcomes the bottleneck of the traditional laboratory-scale spin-coated PSC technique unable for large-area module manufacturing (i.e., upscaling). The above-mentioned process combines slit-die coating with roll-type continuous coating process, and successfully implements a fast and universal process to coat each film layer on a flexible PET substrate. The large-area flexible transparent PSC module developed by INER accomplishes efficiency up to 6% and transparency of 50%, so it can be fully attached to the transparent plastic agricultural greenhouse to achieve the vision of agrivoltaics.



The flexible transparent polymer solar cell module developed by INER

#### Schematic Diagram of Integrating INER's Technology for PLA Production and Chemical Recycling

Using diverse and abundant non-grain biomass as feedstock is one of the key characteristics of INER's polylactic acid (PLA) production technology. Unlike starch and sucrose, more processes with advanced technologies for pretreatment of lignocellulosic biomass are required to produce optically pure L-lactic acid and D-lactic acid, which can be further polymerized into PLA. Moreover, INER has also developed a chemical recycling technology that can decompose PLA back into lactic acid without adding any chemicals. The regenerated lactic acid can be polymerized again into brand new PLA. Looking forward to the future, INER will continue promoting the environmentally friendly bio-plastics, such as PLA and PHAs for versatile applications using self-developed technologies.

