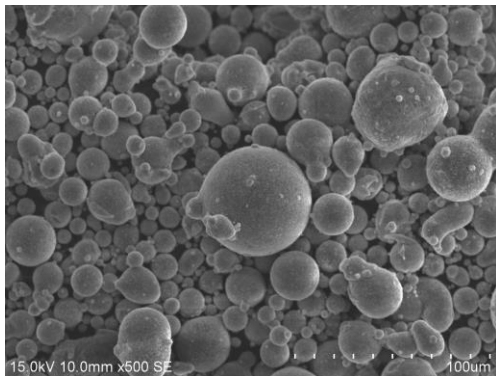


Controllable Hydro-Reactive Magnesium Alloy

MIRDC

Introduction

- Calculating entropy of mixing in the effective alloy through the computational logic of Pascal triangle to use it for controlling the degradation rate of magnesium alloy and fast predicting the atomic ratio of magnesium, zinc, and calcium in magnesium alloy.
- Selecting the best entropy of mixing based on the demand of the application field to adjust hydrogen generation speed so that the water reaction of magnesium alloy can be more controllable, flexible, and even diversified.
- Predicting the most appropriate hydrogen generation amount and speed for the growth of the cultivated species to create an excellent growing environment full of hydrogen and nutrients of magnesium, zinc, and calcium within a specific time though the water reaction phenomenon of magnesium alloy.
- Customizing the degradable implant for human body to fight against body fluid corrosion in order to maintain the degradation reaction at the predetermined speed during the repair process of tissue or bone regeneration.



When manufacturing it into powder, it can be controlled in the average grain diameter (D50) less than 40µm, the circularity greater than 0.7, and with the advantage of no crystal segregation existed, which enhances the variety of subsequent processing into its finished products.



Degradable magnesium alloy hemostatic clip



Awards/Patents

- R & D 100 (2020 Global Top 100 Invention Award)
- 2020 German Red Dot Design Award
- Magnesium-zinc-calcium alloy and the powder of magnesium-zinc-calcium (patent number [I712696](#)) and (application number [108144127](#)); seven patents in R.O.C., U.S.A., and Mainland China.

Industrial Applications/Case Studies

It can be applied in the industries of agricultural technology, life health, and medical care.



The implants of bone nail, hemostatic forceps, or intravascular stent are degraded evenly and slowly within the predetermined time without moving it via the second surgery.



Hydrogen and nutrients of magnesium, zinc, and calcium required for the growth of plants are created within a specific time. The reaction of growth hormone for plants is changed through the hydrogen to enhance the capability of resisting the hostile environment and growing better.

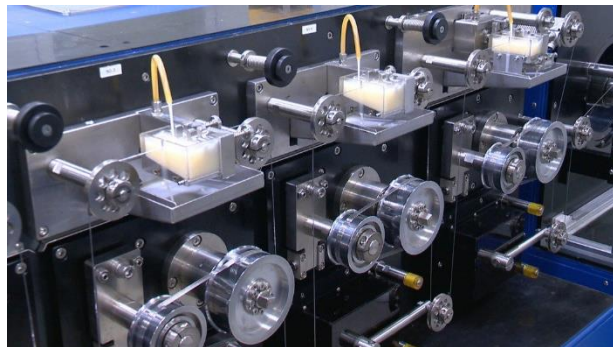
Super Fine Wire Drawing System Technology **MIRDC**

Introduction

- In responding to the multiple demands of wire drawing products, MIRDC established the first domestic demonstration production line in Taiwan for the manufacturing process from material fusion and formulation to shape forming, including alloy design, melting and casting, extrusion, wire drawing, heat treatment, and product testing and verification with the energy of commercialization of key process technology.
- Heat-resistant encapsulated aluminum wires required for high power module which helped the conductivity rate of aluminum wire achieving more than 62% and the resistance to high temperature more than 200°C. It can be used to replace the inlet and effectively solves the issue of aluminum wire softening due to high temperature.
- Pure copper encapsulated wire for semiconductor packaging provides the brazing wire which meets the regulation demands and with a wire diameter $\leq 15\mu\text{m}$.



Super fine wire drawing equipment stabilizes tension and the speed of wire drawing to make sure the shaping is even as well as to enhance the mechanical property and yield rate of the wire material after drawing.

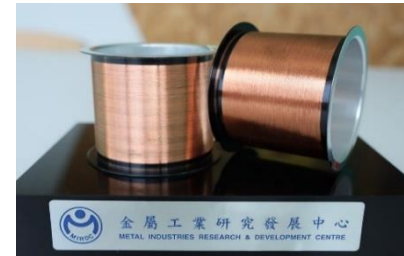


Awards/Patents

- Roller drawing device (patent number: I663003) and the method of extrusion and its products (patent number: I706817); 4 patents in R.O.C., U.S.A., and Mainland China.

Industrial Applications/Case Studies

Gold, silver, copper, aluminum, and nickel-titanium wires, medical wire, degradable magnesium alloy wire, and special alloy welding rod.



Pure copper encapsulated wire of a diameter of $15\mu\text{m}$



Super heat-resistant aluminum alloy wire



Special copper wire

Smart Multifunctional Periodontal Pathology Quick Screening System

MIRDC

Introduction

- **Dental Plaque Fluorescence Detection Module** irradiates the oral cavity with white light and ultraviolet respectively for image taking. The plaque detection is carried out through the fluorescence induced on the plaque irradiated by the ultraviolet.
- Deep learning based on object detection algorithm is established through image recognition and artificial intelligence to automatically identify the tooth position, fill the data related to the tooth in the periodontal digital medical record, and upload to HIS (Hospital Information System).
- **Spectrum Detection Module** carries out periodontal pocket detection in a non-invasive approach via diffuse reflection spectrum technology and chromophore fitting algorithm to collect gingival spectrum data and convert it into blood oxygen saturation data and others important data through the calculation to determine the level of gingivitis.
- Plaque detection can be carried out without applying any plaque disclosing agent and without using a probe to go into the periodontal pocket of the patients to determine the level of gingivitis.
- It is a portable, non-invasive, painless, and fast testing method. The time required for testing shortens from the original 30 minutes to less than 10 minutes. It can be used in the hospital, clinic, medical center of community, or at home.

Awards/Patents

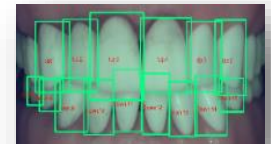
- 4 patent portfolios; 3 in R.O.C. and 1 in U.S.A.

Industrial Applications

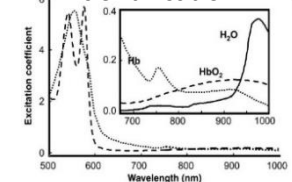
- Plaque and tooth decay detection
- Gingival health testing



Smart Multifunctional Periodontal Pathology Quick Screening system



Tooth position (number) identification



Chromophore Fitting Method



Web-based periodontal care case management platform system

Digital Surgery 3D Optical Positioning Technology **MIRDC**

Introduction

- **Far-near field 3D composite IR real-time positioning scanning module:** Developing random pattern structured LED lighting tracking probes to carry out projection and image taking through the binocular 3D vision single probe configuration as well as integrate with 6DOF multi-icons tracking functions.
- **3D compound mark positioning tracking device technology:** Designing and developing QRCode 6DOF compound sphere in PEEK material with ORCode identification mark. The diameter of the sphere is 32mm and the marked machining accuracy is $\leq \pm 0.035\text{mm}$. The optical characteristics of QRCode are enhanced through coating technology with an identification rate $\geq 95\%$.
- **3D point cloud and multi-target 3D visual positioning technology:** Integrating multi-dimensional mark and image identification algorithm to trace 10 sets of ID at the same time. It uses 6DOF posture as the based to carry out georeferencing to achieve the second accurate positioning. The accuracy of positioning is $\text{RMS} \leq 1\text{mm}$.
- Solving the issue of navigation image data drifting caused by the failure of multi-point tracking within local small area on the location marker frame volume image currently used in clinic for the existing navigation and surgical assisted system.
- Based on the surgical field and demand specification, IR positioning tracking probes can be flexible located. It can also match with the implants/ tools from different manufacturers. The down-sizing marker does not occupy space.

Awards/ Patents

- 3 patents in Taiwan and U.S. in total, including the patent portfolio of real-time positioning method.

Industrial Applications/ Case Studies

- Bone surgery positioning, minimally invasive surgery positioning, and digital puncture guidance



Dodecahedron 6DOF
3D marker

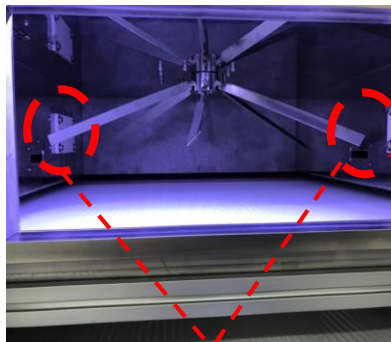


Far-near field 3D optical
positioning system

Microwave Process and Equipment Technology **MIRDC**

Introduction

- The design of asymmetrical waveguide distribution not only effectively homogenizes the distribution of microwave field but also reduces microwave retroreflecting back to the waveguide so that the life cycle of the magnetron can be hugely enhanced.
- It gets rid of the traditional method to spread the energy of standing wave on microwave though rotating disk and disturbance sheet so that the microwave equipment can be effectively used on industrial continuous production application.
- **Small width continuous microwave equipment:**
 - Microwave frequency: 2.45GHz
 - Area of microwave action: 60x60cm²
 - Maximum microwave power: 2000W
 - Electric intensity consistency level: $\geq \pm 90\%$
 - Tolerance of temperature control: $< \pm 5\%$
 - Substrate transmission rate: 0~6 m/min
- **Large width continuous microwave equipment:**
 - Microwave frequency: 2.45GHz
 - Area of microwave action: 180x60cm²
 - Maximum microwave power: 6000W
 - Electric intensity consistency level: $\geq \pm 90\%$
 - Tolerance of temperature control: $< \pm 5\%$
 - Substrate transmission rate: 0~6 m/min



Design of asymmetrical microwave implementation

Awards/ Patents

- 2018 Taipei International Invention Show & Technomart, Silver Award
- 6 patents in key equipment and manufacturing process portfolio; 4 in R.O.C., 1 in Mainland China, and 1 in U.S.A.

Industrial Applications/Case Studies

- ◆ It has been applied on the drying of functional dressing mixture, manufacturing process for shoes, cracking of petrochemical materials, recycling of waste fluid, and texture dyeing...
- It has been implemented technical authorization and transfer or industrial services (such as application on microwave heating and drying device/ application on the development of functional dressing mixture curing equipment...)



Cardboard dryer



Vacuum microwave dried fruit equipment



Glass coating curing machine

Introduction

- **Technology R&D:** Implementing the subsystem technology research on advanced combustion technology, innovative architectural distributed control system, e-supervision and energy-saving optimization technology, modular system design & simulation technology, and optimal furnace type as well as establishing demonstration field to continue deepening technology and core energy.
- **Reconfigurable technical integration:** Implementing reconfigurable subsystem design on standardized burner, heat regenerator, controlling system, international standard safety valve station portfolio, and the optimal furnace type based on the different field of use with an innovative thinking style of making it easy.
- **Modular rapid design:** Different from the old heat generation industrial furnace manufacturing equipment design and the development process, the modular rapid design can be based on the demand of manufacturing process from the customers and combined with new technology implementation and specification portfolio to establish an instant evaluation and analysis technology and further shorten the development cycle.
- **Professional customization:** Large furnace with customized heat generation equipment is usually very expensive, and users will not be able to obtain real-time technology support. In the end, the schedule of implementation is usually too long and hugely affecting the production capacity.

Awards/ Patents

- Awarded the 6th National Industrial Innovation Award
 - Awarded 2019 Excellent Performance "Value-Added Contribution Award" by Bureau of Energy
 - 2020 Energy Award, Gold Award, by Bureau of Energy
- 13 patents in R.O.C. and its related to key equipment and manufacturing process portfolio.

Industrial Applications/ Case Studies

- ◆ It has been applied to steel industry, metal product industry, casting industry, chemical industry, and fire-resistant material industry.
- It has implemented technical authorization and transfer or industrial service (such as the development of heat generation stainless steel thick sheet solid solution furnace/ heat generation zinc oxide manufacturing equipment and so on)



Metal continuous heat treatment furnace



Steel ingot continuous heating furnace



Powder metallurgy continuous sintering furnace