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You Can Print It:
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Upside Down?
Ceramic Dental Implants, the
Better Choice.



Department of Vehicle
Engineering Leading the Way
for Electric Vehicles



Civil Engineering:
One of the Oldest
Departments in Taipei Tech



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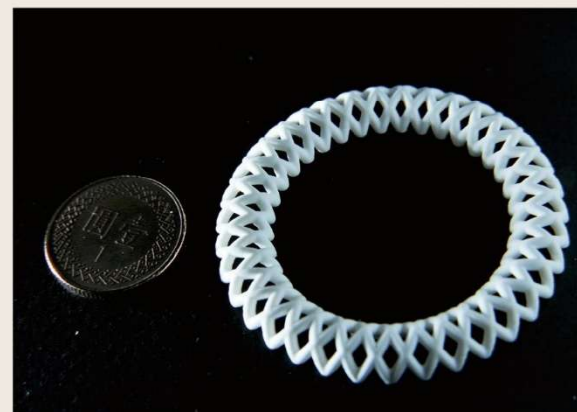
If You Can Think of It, You Can Print It: The Wonders of 3D Printing

Rebecca Lynn Li

The greatest gift that anyone can have is imagination. With that imagination, one can dream up all sorts of different things. However, being able to possess a model of one's design isn't as easy as it sounds. With all the materials available in the world, constructing a prototype is a daunting and tedious task, which can sometimes lead to unsatisfactory results. In the past three decades, an easier and more efficient way has been discovered: 3D printing. Very soon, if one can have come up with a design, one can produce a model of it.

3D printing, also known as additive manufacturing, generates three dimensional objects by successively adding layers on top of each other. One way of building these layers is to fuse layer after layer of powder together by a laser; another way is to bind together sheets of materials layered on top of each other. There are many different ways of classifying the technology of 3D printing, such as by the materials used to form the model, the way each layer is formed, and the way the thickness of each layer is controlled. However, the American Society for Testing and Materials (ASTM) boiled down the myriad methods into seven types. Of the seven types, Professor Jia-Chang Wang (汪家昌) of the Mechanical Engineering Department at Taipei Tech posits that Vat Photopolymerization, Binder Jetting and Material Extrusion are the three types that are most suitable for development in Taiwan, because Taiwan has pre-existing related technology.

Vat Photopolymerization uses a light source to selectively harden a vat of liquid photopolymer layer by layer. Similar to Vat Photopolymerization, Professor Wang's method of 3D printing is called Solvent-Based



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Slurry Stereolithography and Sintering. With this technique, Professor Wang and his research team successfully printed many models complete with intricate details using very tough ceramic material. The greatest advantage of Professor Wang's 3D printing method is the lack of need for support structures when printing models with overhanging parts. In other words, there is no geometric limitation on the models that his method



Actual finished products printed from the 3D printer. On left, miniature lion figure (approx. 1.2 x 0.3 x 0.6 cm)

can produce. After completing many scans of a large wooden version, Professor Wang printed a miniature version of a lion figure approximately 1.2 cm in length, 0.3 cm in width, and 0.6 cm in height. The material is alumina, and the flexural strength is 470MPa. From the muscle on the body to the detailed lion's mane right down to the lion's tiny ears and the shape of its claws, the details on the lion are truly astonishing. With 3D printing currently able to print layers as thin as 0.02 mm, Professor Wang seeks to explore using different materials and strives to increase the stability of the printed result. Professor Wang explains that the most important thing in 3D printing is to ensure that no mistake arises when any of the layers is created.

The big question that people are asking about 3D printing is, where will this technology take us? While Terry Gou (郭台銘), Chairman of Foxconn, believes 3D printing is a gimmick, Professor Wang sees customization as the way to go. Instead of mass producing at a lower cost of production at a factory and selling globally, Professor Wang reasons that small locally owned businesses serving the people living in the immediate areas would be the initial step in future development. Professor Wang points out, "the greatest advantage in 3D printing is that no two printed results need to look the same." 3D printing would be able to customize the product exactly to the customer's preferred shape and design. To illustrate his point, Professor Wang brings up the fact that not everyone can find a pair of eyeglasses that fits perfectly, as the market only offers limited frame sizes. The solution could lie with 3D printing.

Since its initial development in the 1980s, 3D printing has made enormous strides and it has a great potential to be, as President Obama describes it, "Revolutionary". Professor Wang, with remarkable achievements from his method of 3D printing, is continuously advancing towards the next big breakthrough. It won't be long until the world knows what else the 3D printer can print.

Ready to Turn That Frown Upside Down? Ceramic Dental Implants, the Better Choice

Rebecca Lynn Li



Leading the research teams, Taipei Tech's Professor Sea-Fue Wang (3rd right) and Taipei Medical University's Professor Sheng-Yang Lee (3rd left) with their research team members.

train their students to be able to use their knowledge to engineer innovative materials with technological applications to meet the needs of the country.

Losing a tooth is nothing to smile about. If it is one of the central or lateral teeth, the tooth leaves a large gaping hole for everyone to see. Now with the most cutting edge research development in dental implants, even if you fall prey to tooth decay, gum disease, or just had a nasty fight, there is nothing preventing you from smiling in front of the camera for your next Facebook profile picture.

The latest stir in the world of dental implants is the ceramic dental implants produced by the combined research teams of Taipei Tech and Taipei Medical University. This collaboration is made possible by the educated professionals of Taipei Tech in the research and development of the material for ceramic dental implants, and by Taipei Medical University in the restoration and cosmetic improvement of the human teeth. Continuously producing remarkable results, the Department of Materials and Mineral Resources Engineering of Taipei Tech has the mission of not just to educate students. The staff in the department strives to impart the most fundamental knowledge about materials, and

Currently, what Taiwan needs is to not depend on foreign imports for dental implants. Each year, Taiwan imports about thirty thousand titanium dental implants. After the ceramic dental implant is introduced on the market, it will bring approximately NT \$250 billion in re

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Prototypes of the different types of ceramic dental implants.

venue for Taiwan's economy. Professor Sea-Fue Wang (王錫福), Vice President of Taipei Tech, chairman of the Center of EMO Materials and Nanotechnology, and representative of Taipei Tech's research and development team, points out, "this new material for ceramic dental implant is firmer and more durable, which makes it easier to manufacture and has a lower cost of production". Using the most advanced ceramic power injection molding technology capable of mass producing objects with complex geometries, ceramic dental implants would soon be available on the market.

This type of one-piece dental implant made from zirconium oxide is more aesthetic and more biologically compatible with the human body compared to the traditional titanium implants. Since it is a one-piece implant, patients who dislike going to the dentist can finish the surgery in one sitting, and they don't need to worry about the problems and the need for maintenance that come with two piece implants. Closer to the color of the human teeth, the ceramic

dental implant has a more natural color as opposed to the dark lines that would be left around the gum from Titanium implants. There is a possibility that Titanium implants would leave more than just dark lines around the gum. It can cause swelling, allergic reactions, inflammation of the gum tissue, and movement of the implant which can result in failure of the treatment. Ceramic dental implants, however, underwent numerous tests conducted by the SGS to ensure compatibility with our body. It is the cheaper and healthier choice of dental implants, which can help guarantee a longer lasting smile.

With all the delectable food that exists in Taiwan ranging from the gourmet dishes in restaurants to the old favorites in the stalls of the night markets, there is a need for people in Taiwan to possess a set of healthy teeth. Ceramic dental implants, with all its advantages, are the way to go for people to look great and eat to the heart's content. Right now, with no more than 10 companies in the world manufacturing ceramic dental implants, the success of Taipei Tech and Taipei Medical University has allowed Taiwan to move into the market space that is "blue ocean".

Department of Vehicle Engineering Leading the Way for Electric Vehicles

Rebecca Lynn Li

"Help Taiwan's Car Industry come up with the next step!" said Professor K. David Huang (黃國修), chairman of the Department of Vehicle Engineering at Taipei Tech. Originally a part of the Mechanical Engineering Department, the Department of Vehicle Engineering was set up as an independent department in 1997. Esteemed faculty members provide interdisciplinary education, with emphasis on hands on experience to prepare students for later research or to enter the industry. Following the megatrend of the car industry of producing intelligent, clean, and safe vehicles, the department shifted its focus from repair and maintenance of vehicles towards conducting research on the frontiers of vehicle engineering.

The four features of the curriculum and research of the Department of Vehicle Engineering include Electrical Control, Design, Power, and Energy. The department's interdisciplinary structure guides students to look at a system as



Hybrid electric motorcycle with inverse differential gear.

an integrated whole, and understand how each part works in relation to the whole system in order to create value innovations. "Each one of our students is a car doctor," states Professor Huang. Like the outstanding alumni working at managerial positions of major car companies such as Hotai Motor (和泰汽車公司) and Yulong Motors (裕隆汽車公司), many talented and skilled students are continuing to walk through the halls of the Department of Vehicle Engineering.

Currently, one of the research studies conducted in the Department of Vehicle Engineering explores a new source of power for vehicles. Benson Sheng (沈大鈞), a second year Masters student, has been working on a Hybrid Electric Motorcycle with Inverse Differential Gear. This prototype has an integrated propulsion system comprised of an electric motor and an internal combustion engine. Capable of recapturing the energy lost when the motorcycle is coasting or breaking and converting the energy back to electricity, this motorcycle also reduces fuel consumption by 40% and emission of carbon monoxide and hydrocarbons by 50%. The Patent rights for the development of this type of hybrid electric system is owned completely by Taiwan and by combining the motor and generator, there is a decrease in the complexity, cost of production, and weight and volume of the system compared to the existing technologies in foreign countries.

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Ever feel so hot in the car while everyone feels that the temperature is just right? Students in the Department of Vehicle Engineering not only research ways of making vehicles more ecofriendly; they also explore new user-friendly designs to implement in vehicles. Heat enters a vehicle in various forms such as sunlight, the heat of the engine, and heat of the exhaust. Nevertheless, the air conditioning systems in vehicles today are sufficient enough to lower the temperature. However Ken Song's (宋彥勳) air conditioning system design goes beyond just controlling the temperature and the wind speed to maximize the

comfort of the passengers. Ken strives to separate and keep constant the currents of air felt by each passenger in the car so each individual can adjust the thermostat to their preferred temperature. In his simulation of a vehicle, Ken attached thermal couples to the mannequins to simulate body heat, set up high power lamps to simulate sunlight, and used vapor in order to see the flow of the air current.

Currently carrying out cutting edge research and producing remarkable results aptly demonstrated by these two students, the Department of

Vehicle Engineering is well on its way to revolutionizing the car industry.



Specialized air conditioning system being tested with thermal mannequins to simulate body heat.

Civil Engineering: One of the Oldest Departments in Taipei Tech

Rebecca Lynn Li



The Gambian students from the Department of Civil Engineering surveying the Shu-Yuan expressway's Riverside walkway.

The Department of Civil Engineering in Taipei Tech has had a one-hundred-year history since Taipei Tech was established in 1912. The Civil Engineering Department in Taipei Tech is also the first department in Taiwan to integrate Disaster Prevention into its graduate school with the establishment of the Graduate Institute of Civil and Disaster Prevention Engineering in 1997. "Our greatest turning point", said Department Chair of Civil Engineering, Professor Shong-Loong Chen (陳水龍), "is when our university became a research university." In 2012, the Department of Civil Engineering was ranked 117 worldwide by the QS World University Ranking in the subject of Civil Engineering.

A defining feature of Taipei Tech is the amount of research that is conducted on campus every day. In the Department of Civil Engineering, each professor, with their own background and area of specialties, lead their students in conducting a wide

range of research geared to building sustainable infrastructures that will meet the challenges presented by the ever-changing environment. As Taiwan is targeted by natural disasters such as typhoons and earthquakes every year, research is guided by the general goal of disaster prevention. Researchers are equipped with state of the art equipment, such as Unmanned Aerial Vehicle (UAV) and LiDar and funding to conduct research as they see fit. The categories of research include Structural Engineering, Geotechnical Engineering, Construction Management, Eco-engineering, Disaster Mitigation, Information Technology, Water Resource Engineering, and Hazard Mitigation.

The Department of Civil Engineering is also home to students that are part of the extension education programs and many international students from around the world. "Attending classes either during nighttime or on the weekends, the Taipei Tech Civil Engineering students are very motivated in their studies," said Professor Shong-Loong Chen (陳水龍) when describing the students enrolled in the extension education programs. "They are sometimes students who discover their true passion after entering the workforce". The largest group of international students in the Department of Civil Engineering is the group of Gambian students in the Gambian

Civil Engineering Class. First established in 2008, the Gambian Civil Engineering Class aims to train talented Gambian civil engineers for the socioeconomic development of Gambia. Last year, the twenty four Gambian students finished their four year bachelor's degree and this year, the Department of Civil Engineering welcomed the second group of Gambian civil engineering students to Taiwan.

In the Department of Civil Engineering, students with vastly different backgrounds come together to learn and thrive. They are given opportunities for internship with industries outside of the university during the summer to gain experience, and they work with renowned faculty members to conduct the most innovative research. With disaster prevention as their new guideline, the Department of Civil Engineering carries on their tradition of excellence in teaching and conducting research into the next century.



The Gambian Civil Engineering students on a field trip to Beitou Hot Springs Museum.

Wish you have a great day ahead,

A handwritten signature in black ink, reading "Wenlung Li". The signature is written in a cursive, flowing style.

President

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