



Showcase for PolyU invention at its best 理大創新實力盡顯現

At the annual Innovation Expo organized by the Innovation and Technology Commission at the Hong Kong Convention and Exhibition Centre from 14 to 18 September, which coincided with the 10th Anniversary of the Hong Kong SAR as a major celebratory event, PolyU inventors showed up in force with over 80 of their state-of-the-art innovations.

Miniaturization moulding machine a world first

The highlight of the PolyU exhibits was a bottom-up high-precision micro-injection moulding machine, the first of its kind in the world. According to Principal Investigator of the project, Prof. Yung Kai-leung, Associate Head of the

University's Department of Industrial and Systems Engineering, this machine is designed for producing miniature parts as light as 0.01 gram. Such a cutting-edge technique is made possible by adopting a revolutionary upward injection design to eliminate the air entrapment problem and the need for shutoff. In contrast, for other moulding machines only a reduction in size of conventional designs is possible.

This PolyU innovation will find extensive applications in the miniaturization of products and the production of high-precision micro



The Micro-Injection Moulding Machine was unveiled by Mr Anthony Wong (middle), Commissioner for Innovation and Technology. 創新科技署署長王錫基先生(中)為理大研發的「向上注射式高精密微注塑機」主持啟動儀式。

plastic parts such as micro bio-mechanisms, micro-pumps, medical parts, micro lenses and optical connectors. For this reason, this ground-breaking invention was awarded a Gold Medal in the International Exhibition of Inventions, New Techniques and Products of Geneva in April this year.

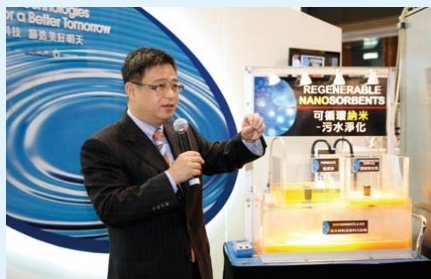
Developed at PolyU's Microsystems Technology Centre established in 2005 with substantial funding from the Innovation and Technology Fund, this technology is now ready for commercialization. Prof. Yung has already secured one US patent and filed four patents in different countries and territories for this breakthrough design.

(From left) Dr Li Pei; Mr Anthony Wong; Mr Frederick Ma Si-hang, Secretary for Commerce and Economic Development; Ir Daniel Cheng, Managing Director of the Dunwell Group and Dr Lui Sun-wing, Vice President (Partnership Development)
(左起) 李蓓博士、王錫基先生、商務及經濟發展局局長馬時亨先生、正昌集團董事總經理鄭文聰先生及副校長(產學合作)呂新榮博士





Mr Andrew Young, Head of Partnership Development Office
企業合作處總幹事楊孟璋先生



Dr Daniel Cheng introducing the Group's collaboration with PolyU.
鄭文聰先生介紹與理大的合作計劃。



Financial Secretary Mr John Tsang Chun-wah (second from left) showing interest in the Fiber Optic Sensor System for railway monitoring.
財政司司長曾俊華先生(左二)對光纖傳感鐵路監察系統甚感興趣。

Partnering with business to clean up the water

At the Collaboration Announcement with the Dunwell Group, PolyU made an official announcement of its collaboration with the Dunwell Group, by which the company is licensed by the University to produce a novel wastewater treatment technology, the Regenerable Nanosorbents technology developed by its Department of Applied Biology and Chemical Technology.

The innovative and environmentally-friendly technology, which has been put under stringent laboratory and pilot tests and proven to be very effective, is expected to be available for commercial use in 2008.

Other PolyU innovations showcased at the Expo included the Fiber Optic Sensor System for railway monitoring, the Smart Dressing System for advising mix-and-match styles to customers, the Telehealth System and the Smart Car, an innovative environmental electric vehicle developed by the Power Electronics Research Centre. The care apparel developed by PolyU's Troels H. Povlsen Care Apparel Centre was also displayed and demonstrated. ❖

Dr Lui, Prof. Yung (fourth from right) and the research team of the Moulding Machine
呂博士、容啟亮教授(右四)和「微注塑機」研究團隊

理大於九月十四至十八日在香港會議展覽中心舉辦的創新博覽會中，展出八十多件創新科技成果。創新博覽會由創新科技署主辦，是慶祝香港特別行政區政府成立十周年的主要節目之一。

微注塑機 全球第一

理大展品中包括世界首部向上注射式高精度微注塑機。項目的首席研究人員工業及系統工程系系主任容啟亮教授表示，該部微注塑機使用革命性的向上射膠設計，避免空氣混入熔融，不用閥門，能注塑輕至0.01克的微型部件；其他注塑機只著眼於縮減射膠設計的大小。

該項理大發明能廣泛應用於生產微型產品和高精密度的塑膠部件，例如：微型生物裝置、微型唧筒、醫療部件、晶片及光學接駁器等，因而在本年四月瑞士日內瓦第三十五屆國際發明及創新技術與產品展覽中榮獲金獎。

該部微注塑機在理大微型系統科技中心

研製，已研發成功，並可立即投入生產。容教授已為該發明取得美國專利，另已於四個國家和地區提出申請專利。理大微型系統科技中心獲創新科技基金大力支持，於二零零五年成立。

拍夥商界 淨化污水

理大亦正式公佈與正昌集團的合作計劃；校內應用生物及化學科技學系副教授李蓓博士成功研製出一種用於高效環保污水淨化的全新納米材料，此污水淨化技術的專利權已授予正昌集團。

是項創新又環保的發明已經過嚴格的實驗室測試和小規模應用測試，證明十分有效，可望於二零零八年推出市場。

是次創新博覽會上還介紹了理大的其他發明，包括：光纖傳感鐵路監察系統、智能服飾配襯系統、遙距健康網絡系統和電力電子研究中心發明的環保電動汽車等。此外，理大綾緻康健服裝中心亦展出康健服裝，並由專人示範。 ❖



Synergizing the spheres of influence in research

To maximize synergy across different academic units and encourage interdisciplinary research, PolyU has earmarked an annual \$10 million from its Research Budget since 2001/2002 for supporting collaborative projects across disciplines.

The resulting research outputs have shown much promising progress in a number of target areas. The project "Environment-friendly New Thermal Energy Storage (TES) material" is one of the more notable examples.

Saving energy to save the environment

In an attempt to address the problem of global warming, Research Centre for Building Environmental Engineering of Department of Building Services Engineering (BSE), led by Associate Professor Niu Jian-lei, is working on the development of New Thermal Energy Storage (TES) material to realize low-energy building cooling and heating. One of the technologies developed is the nano-technology-based, micro-encapsulated phase-change material (MPCM).

When the MPCM is mixed with water, milky slurry is formed, which can function as TES and heat transfer working fluid to replace the plain water or ice-slurry

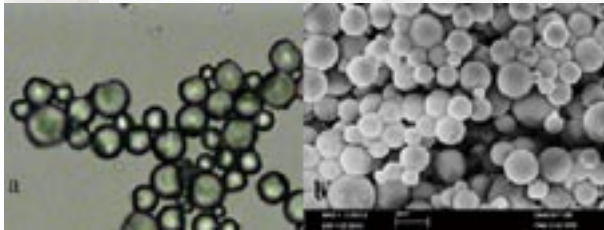
now commonly used in building cooling systems. Depending on local climatic conditions, TES can eliminate the use of electricity-driven chillers, which consume the most electricity in current air-conditioning systems.

At this stage, the new PCM slurry has been tested with its flow and heat transfer characteristics, and the scientific research results have been published in the authoritative *International Journal of Heat and Mass Transfer* (Vol. 50, pp 2480-2491, 2007). An air-conditioning system using night-time electricity for daytime cooling being built in the laboratory of BSE is expected to be ready for demonstration by October 2007.

Three core competencies as one

In the research community, efforts to develop TES material date back to the energy crisis in the 1970s. Dr Niu, Principal Investigator of the project, attributes the breakthrough to the multi-disciplinary research collaboration with PolyU's Institute of Textiles and Clothing (ITC), Tsinghua University in Beijing and Delft University of Technology in the Netherlands. The MPCM is developed at ITC, and the mixed use with water as a working slurry is conceived by the BSE team, and the flow and heat transfer test is done at the sophisticated test-rig at Tsinghua University.

The research is supported by the Government's Innovation and Technology Fund (ITF) and Competitive Earmarked Research Grant (CERG) of the Research Grants Council. Under the HK\$0.89 million support of ITF, the preparation of the new material and a demonstrative air-conditioning system have been completed by August 2007. With the CERG funding of over HK\$500,000, the system is undergoing performance estimation under a variety of climatic conditions using computer simulations. A design guide will be available to Heating, Ventilation and Air-Conditioning (HVAC) design engineers by mid 2009.



Optical micrograph (left) and SEM (scanning electron microscopy photograph) of PCM microcapsules

跨學科研究 迭拓新境域

本校一向提倡各校各學系之間通力合作，更為鼓勵跨學科研究，自二零零一至零二年度起，每年在研究經費中撥出一千萬元，以支援各跨學科協作研究項目。全賴校內各學系的共同努力，理大近年來在多個目標領域均取得驕人成績，「新型環保相變蓄熱(TES)材料」是其中一個顯著例子。

節能環保的嶄新物料

正當全球變暖這個關乎人類存亡的問題日受關注的同時，理工大學的科研人員亦全力尋求解決問題的工程技術。屋宇設備工程學系副教授牛建磊博士與他的研究團隊，利用納米技術，成功研製出一種「微膠囊相變材料」。該材料以適當的比例與水混合後，形成狀似牛奶的漿液，可用作工程上所需的蓄熱與傳熱流體。當用於建築空調與供暖系統中，可顯著減低系統用電量，使夜間本來無法利用的低價電可以熱量或冷量形式儲存於裝有該漿液的裝置中，以供應日間的需要。在合適的氣候條件下，更可以將太陽能集熱，或將夜間低溫時段的天然冷量更有效地儲存，進一步降低生活熱水和空調用電量。

通力合作的科研成果

自從二十世紀七十年代的能源危機以來，為了減少建築供暖與空調用電，從事建築節能的研究人員就一直在開發研製各種相變材料。但至今工程上仍然以熱水和冰作為蓄熱材料。用熱水或冷水的缺點是蓄熱設備體積龐大，而冰蓄冷技術浪費能量的問題一直存在。以往的相變材料漿液，亦因存在分離與沉澱等技術問題，而一直未能取代水和冰。理大的技術突破，關鍵在於跨專業合作及同時間的國際合作—微膠囊技術是紡織及製衣學系的科研小組多年探索的成果，而最終以漿液的形式應用，則由屋宇設備工程學系根據建築空調系統的特點而選定的技術方案，該技術的傳熱實驗則在清華大學完成。

該研究項目已獲香港特區政府創新及科技基金和研究資助局的支持，有關實驗結果的科技論文亦已在傳熱學領域國際級期刊《國際傳熱傳質雜誌》(*International Journal of Heat and Mass Transfer*) 發表。是項研究正利用電腦模擬系統進行各種氣候環境下的表現測試，並將於二零零九年為工業界提供應用指南。

Shedding light on auditory function of the brain

New clues which help explain the auditory function of human brains identified by Dr He Jufang, Associate Professor of PolyU's Department of Rehabilitation Sciences, and his colleagues were published in a research paper in the July issue of the authoritative *Proceedings of National Academy of Sciences (PNAS)* of the United States.

Intrigued by the "Cocktail Party Phenomenon" or why people could selectively attend to a particular speaker in a noisy environment, Dr He is keen to find out how this filtering mechanism in our auditory system and brain works. Collaboration with physiology experts from the University of Hong Kong over this research led Dr He and his partners to conclude that the executive circuit of this active filter is located in the thalamus.

Thalamus, a centrally-located brain structure that controls the flow of all information to the cortex, has been regarded simply as a "relay" that forwards signals to the cerebral cortex. However, newer research findings, including Dr He's *PNAS* paper, suggest that the thalamic function is much more complicated than previously presumed.

Using a combination of electrophysiological and immunohistochemical methods, Dr He and his team found that the other part of the auditory thalamus is actually involved in modulating the global alertness of the auditory cortex, as well as in switching the cerebral cortex from working mode to sleeping mode and between different sleeping phases. Compared to the ascending geniculocortical projection, the thalamus receives a much larger reciprocal projection from the cortex. The corticothalamic projections are part of the key circuit of the filter which tells the thalamus what information from the periphery should be allowed to pass on to the cortex.

The research team has also found the correlation between a neural activity marker, *c-fos* protein expression, in the auditory thalamus and synchronized burst activities between the cortex and thalamus. The findings will not only lead to further discoveries regarding the mechanism of *c-fos* expression, but will also provide a powerful tool for unlocking the secrets behind tinnitus and other neurological diseases.



Size matters in design

The world's first database storing 3D head and face measurements of ethnic Chinese has come into use, after 18 months of dedicated efforts by researchers of PolyU's School of Design (SD).

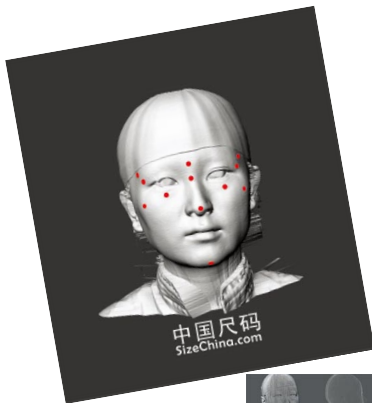
According to Mr Roger Ball, Director of "SizeChina.com" project and Assistant Professor of SD, such ergonomic data is in great demand since many existing consumer products are designed for Caucasians, and so do not fit Chinese people properly.

"Understanding human size and shape is the cornerstone for designing successful

consumer products because every product relies on accurate fitting. Sophisticated digital data on head and face shapes is required to design the next generation of best-selling products," he added.

Mr Ball and his team visited six mainland cities including Guangzhou, Hangzhou, Lanzhou, Chongqing, Beijing and Shenyang, and collected the head forms of more than 2,000 volunteers, aged from 18 to 70, using a 360-degree rotary non-contact head and face scanners.

With the completion of the first phase of



掌握「頭」寸的設計



this project, PolyU researchers have come up with five standard head forms of ethnic Chinese. The project was kicked off in April 2006 with nearly \$4.5 million funding support from DesignSmart Initiative of the Government's Innovation and Technology Commission, under the project title "Perfect fit China". It is also supported by several industrial partners, including UGS PLM Solutions and Strategic Sports.

Details of the project and the related research results are available at the following website: www.sizechina.com.



理大設計學院的研究人員在過去兩年走遍大江南北，搜集了詳盡的華人頭型和臉型三維數據，建成全球首個同類型的網上資料庫。

據「中國尺碼」項目負責人兼理大設計學院助理教授Roger Ball表示，有關數據的需求很大，因為現時市面大多數消費品專為西方人設計，尺碼並不適合華人。

他續稱：「掌握人體的尺碼和形狀是產品設計成功的關鍵，各種消費品其實都有必要量體裁製，而詳盡的頭部和臉型數據，對設計暢銷的新產品至為重要。」

理大研究人員先後走訪廣州、杭州、蘭州、重慶、北京及瀋陽六個內地城市，使用三百六十度環迴式掃描器蒐集了二千名華人的頭型與臉型資料。研究對象由十八歲至七十歲不等。

隨著「中國尺碼」研究首階段的完成，理大研究人員製成五個可供全球工業設計師參考的華人標準頭型尺碼模型。此項計劃於二零零六年四月正式展開，以Perfect Fit China為題獲設計智優計劃資助港幣四百五十萬元，並獲UGS PLM Solutions和Strategic Sports與多家本地工業機構資助及支持。項目詳情可瀏覽網址www.sizechina.com。



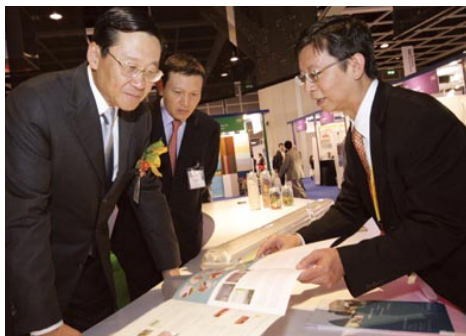
獨市環保磚鋪出百萬大道

陳俊允（左）、黃智豪（中）和林志陞於去年七月開始生產環保地磚，僅去年下半年已有二百萬元營業額，現正準備發展國內市場。



潮流興環保，環保袋、環保衣料、再造紙，還有環保磚。林志陞及陳俊允在理工大學研究用棄置玻璃造磚，並於去年七月夥拍陳的中學同窗黃智豪成立納比迪環保建材有限公司，以回收玻璃造成地磚出售。現時，位於屯門的環保園、中大、理大、城大及一些政府部門都買入他們的環保地磚鋪路，單是去年下半年，納比迪已有二百萬元生意額。

「能源和原材料都是供應緊絀的產品，所以我們經營相關的生意，一定得有得做。開始時有些朋友話我傻仔，但如果不做一些與人不同的生意，是賺不到錢的。」林志陞堅定地說。



去年，納比迪參加國際環保展，貿發局主席吳光正亦駐足參觀。



位於大圍新翠邨的行人路就是用納比迪的環保地磚鋪成。

最近，納比迪環保建材有限公司從粉嶺搬到屯門龍鼓灘新廠房，林志陞、陳俊允和黃智豪還在附近以一萬元租了一幢兩層連天台村屋作寫字樓，村屋對正龍鼓灘，坐擁無敵大海景。「雖然新廠和舊廠都是三萬呎，但新廠『見使』好多，可以應付我們愈來愈大的生產量；而且我們遲些會在隔離加建建築廢料處理廠，以建築廢料生產再造石，取代原本用的碎石，那時就可以自己生產埋造磚的原材料。」林志陞笑得合不攏嘴。

他們生產的環保磚，特點是以玻璃取代原本造磚的河沙，再以煤灰取代英泥，另外混合碎石造成。玻璃是棄置的玻璃，煤灰是電力公司的廢料，碎石目前則仍須購買，以三至四元一塊環保磚計，材料成本不足一元，如果日後自行生產原材料，利潤更可觀。

日收二十噸玻璃

香港每日產生約三百噸棄置玻璃，為了環保效益，理工大學自〇三年開始研究以棄置玻璃造磚，林志陞和陳俊允亦有份參與，但畢竟做實驗和做生意是兩回事，在開業初期，單是收集玻璃樽已教他們欲哭無淚。「每個周末凌晨兩點，我們都會去尖沙咀棉登徑收啤酒樽，因為垃圾車六點到，所以我們要快手。初時唔識收，袋到穿晒，又要畀垃圾佬鬧，話我們搶他們的垃圾。」黃智豪笑說。

後來他們懂得預先租貨車，再用手推車運磚上車，但仍有拾荒者嫌他們收得太慢，動手幫忙，這段日子維持了四個月。其後他們與汽水廠、生產樽裝牛奶的公司和機管局等接洽，請他們將棄置玻璃送給他們。「我們要寫建議書解釋用途，然後安排他們參觀廠房，讓他們知道我們真是用作環保用途。」陳俊允表示回收的玻璃，由初時他們每次收集的三噸增加至現時每日約二十噸。

獨家除廢氣功能

一般地磚每塊由一元至十元不等，他們造的環保地磚只屬中價，故市場要慢慢才接受。現時香港的大學已有買入環保磚鋪地，位於屯門的環保園亦以環保磚鋪所有行人路和行車路。「政府現在傾向要承建商用環保料起路，最緊要這些環保料是用香港的廢物

和是香港廠在香港造。」陳俊允笑說他們是香港唯一的環保磚生產商，預料未來生意額將大大提升。

為了吸引政府多用環保地磚，他們除主動向政府部門提交建議書外，更在地磚加入除廢氣功能。此外，他們亦提供五年保養期，「如果塊磚有問題，我們會幫你再鋪過。」林志陞表示他們極重視地磚的壓力測試，所以提供保養只是令政府更安心購入。

另一方面，他們亦與許多學校合辦活動做宣傳。「我們要學生收集玻璃，邀請他們來廠參觀，將他們的玻璃造成地磚，讓學校買回去鋪路。雖然這樣做無錢賺，但可以有宣傳作用。」林志陞說。現時他們亦正與廣東省的建材公司洽談，希望生意可延伸至國內市場。

雖然環保磚潛力大，他們坦言不怕有競爭者出現，因為造環保磚技術很難抄襲，就連在理大有份參與研究的林志陞和陳俊允，在開業時亦苦不堪言。「以前做實驗，每日只造十塊磚，做生意點得呀？」林志陞苦笑。



納比迺獲得二零零六年度「創業奇兵」的業務大獎。

獨得理大生產權

成立公司之前，他們單是買碎玻璃機器和嘗試收集玻璃磚已籌備了半年，另外再花半年作市場調查和找尋環保地磚的銷路。「就算有做研究，都只系紙上談兵，大家對機器都好陌生，咪一路搵、一路問，再一路學咯！」黃智豪指廠內的機器是他們尋遍國內買回來的，有些甚至需要改装。

二十八歲的林志陞在理工大學修讀土木工程，畢業論文就是以玻璃造環保磚為題，其後在理大繼續進修，結識比他小一歲的陳俊允。陳在國外同是讀土木工程，回港後在理大任研究助理。二人覺得此技術甚有可為，便於去年七月夥拍當時二十九歲、陳的中學師兄黃智豪合作，向理大取得獨家生產權，並籌得約二百萬資金創業。最初股東只有七人，他們三人是大股東，而至今股東已增至十一人。

賺錢之餘，他們亦希望宣揚環保訊息。林志陞、陳俊允和黃智豪將公司的英文名取為LAPUTA，即宮崎駿筆下的《天空之城》，「因為我們覺得天空之城是一個沒有污染，很環保的世界。」林志陞笑說。

(圖文原載於第二百零九期《東周刊》，蒙允轉載)



林志陞表示每二百塊磚就抽一塊進行壓力測試，行人路地磚最少須承受六十噸重量，行車路地磚則最少九十噸。



除了地磚，納比迺亦準備生產瓷磚。



開業前，黃智豪(左)與兩個拍檔於凌晨在尖沙咀收集棄置啤酒樽。