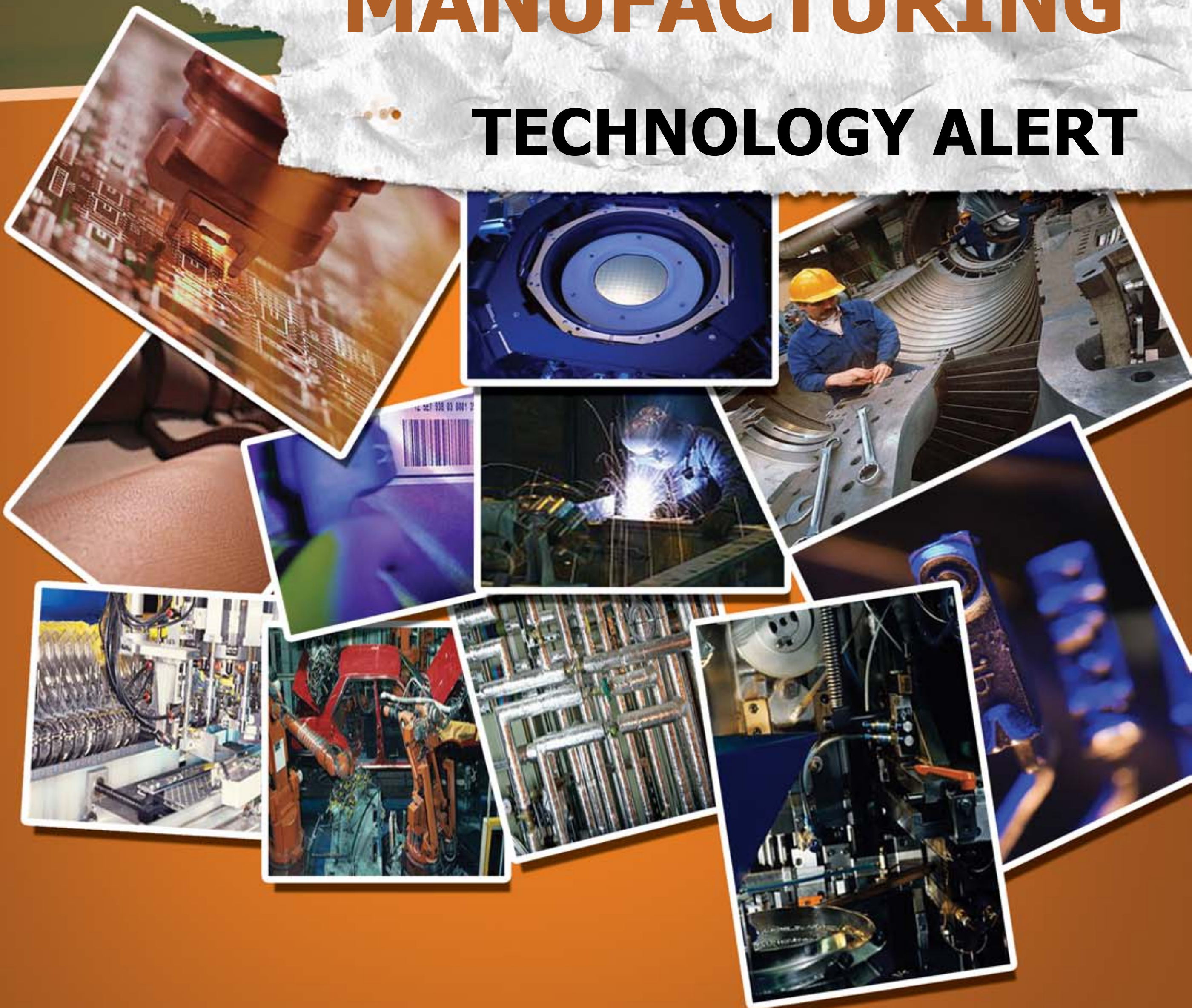
TECHNICAL INSIGHTS

ADVANCED MANUFACTURING

TECHNOLOGY ALERT



29th August 2014

1. 3D PRINTING FOR LED OPTICS

Three-dimensional (3D) printing technology is being increasingly adopted by a wide range of industries for different applications. The major industries in this regard include automotive, aerospace, consumer products, and health care. 3D printing has been employed for a wide range of materials till now, but optics is one sector that has not adopted this technology for manufacturing. LED (light-emitting diode) lighting industry has seen rapid growth in the recent past in which optics are being manufactured using the conventional techniques such as injection moulding. The challenge faced with the injection moulding technique is that the tool used in this process is significantly expensive and also it cannot be used for low volumes. This is primarily because a specific set of tools is required to develop a specific set of optics. Moreover, in case of any defect detected during prototyping, the process for rectifying it is also highly time consuming.

LUXeXceL,(Netherlands), has developed a novel technology named Printoptical Technology that enables the production of optics using 3D printing technology. This pioneering effort gives designers high amounts of flexibility enabling them to develop customized optics for catering to specific customer needs. The company's GEN4 3D printer is based on this technology and uses a piezoelectric controllable head that is capable of providing very high resolution. The material is deposited using discrete drops that result in a smooth surface finish. The material itself is ultra violet (UV) curable. Some of the other advantages of the technology include reduced initial investment, money spent on testing, and reduced production time.

Optics manufactured using the Printoptical Technology does not require post processing. Computer-aided design (CAD) files can be directly sent to the printer. The designs can be customized and stored based on customer requirements and can be printed as and when required. This hugely reduces inventory cost. The technology enables production of optics at a faster rate for small as well as large volumes. The optics can be produced following three simple steps--the user needs to design the optics, then upload it on Luxexcel's Website, and it can be processed for production immediately.

Even though the initial target application of Luxexcel's technology is in the field of optics, it has potential to be adopted by other industries such as automotive and consumer industries. The technology is expected to have a very high impact in the field of LED lighting, which itself has shown high potential and interest amongst different industries.

Details: Richard Van De Vrie, CEO, Luxexcel, Amundsenweg 25, 4462GP, Goes, Netherlands. Phone: +31-113-224-411. E-mail: info@luxexcel.com. URL: http://www.luxexcel.com.

2. CONVERGENCE OF 3D PRINTING AND TARGETED DRUG DELIVERY PROMISES BETTER HEALTHCARE

Three-dimensional printing has garnered a lot of interest in the field of rapid prototyping for healthcare and consumer goods. In healthcare this technology has potential in various applications such as implants, artificial organs, prosthetics, and so on. Some of the limitations faced in prevailing drug delivery systems are related to antibiotic implants. These implants are typically made of bone cements that contain toxic substances. The cement is required to be hand-mixed by surgeons before a surgery, and once inside the body it does not break down naturally. This leads to the requirement of additional surgeries for removal of the implants, which leads to added cost, and causes discomfort for the patients.

A team of researchers from the Louisiana Technology University, USA, has developed a method for fabrication of custom medical implants for targeted drug delivery containing chemotherapeutic and antibacterial capabilities. The custom filaments are made of bioplastics that will get resorbed by the human body after delivering the drug. This removes the need for additional surgery associated with normal implants.

The team of researchers from the biomedical engineering and nanosystems engineering departments of the university created filament extruders that make 3D printing filaments of medical quality. The researchers worked with Extrusionbot LLC, USA, which provided material support for development and testing of the technology. Using such filaments for specialized drug delivery is an innovation that has potential to have a high impact in the targeted drug delivery market of medical implants and catheters. By adding substances such as additives or nanoparticles, the technology can be more useful since the basic 3D printing material is already biocompatible. By adding antibiotics and other medicinal compounds the goal of targeted drug delivery can be achieved while the implant itself can be broken down inside the body over time.

This technology will have a high impact in the field of personalized medicine in which hospital pharmacists and physicians will be able to provide treatment in a new and effective manner. The most important benefit of the technology is that it can be used using consumer 3D printers anywhere in the world. The 3D printing process allows creation of partly hollow beads, which provide high-surface area for integrating higher amounts of drug as well as better control of drug delivery.

Currently, in order to add additives to plastic industrial scale processes are required. However, the University of Louisiana process enables dispersion on table tops, which allows researchers to easily customize the additives. The development represents an example of technology convergence where 3D printing and targeted drug delivery technologies converge to provide better healthcare services. It is expected that commercial application of the process will happen around 2018 to 2019.

Details: David Mills, Professor, Biological Sciences, Louisiana Technology University, Ruston, LA 71272. Phone: +1-318-257-2640. E-mail: dkmills@latech.edu. URL: www.latech.edu

3. ROBOTS FOR CORROSION DETECTION OF INFRASTRUCTURE

Corrosion is one of the major underlying reasons for the failure of aging infrastructure such as bridges and tunnels. Bridges form an integral part of transportation network and require regular maintenance as the structures grow old. This is because carbon dioxide and de-icing salt destroy the reinforced concrete that constitutes a major element of bridges. Corrosion majorly occurs when carbon dioxide from air reduces the high pH level of the concrete or when chloride from salts react with the reinforcing steel in concrete. The major concern regarding corrosion is that it is normally visible at a very advanced stage when the structural integrity is jeopardized. The cost associated with bridge restoration rises exponentially with the increased level of corrosion. It is thus important to have a device that can detect corrosion at an early stage.

A technology to detect corrosion was developed about 25 years ago. It involves an electrode that measures the potential difference across the surface of the concrete. A large potential difference indicates that corrosion has started to affect the area. However, the key challenge with this technology is that the electrode is connected on to a wheel, which needs to be manually manoeuvred. Thus the coverage area becomes limited as it is not possible to access difficult areas such as undersides of bridges and supporting pillars.

To address this challenge, a team of researchers at the ETH Zurich has developed a robot that can move on walls and ceiling apart from travelling on ground. The movement of the robot is based on vortex technology. Basically, a type of propeller is attached underneath the robot which allows it to traverse gravity-defying paths. The robot, called C2D2 (Climbing Corrosion Detecting Device), was originally developed with the idea of filming a room from different perspectives along the walls and ceiling. The team modified the original robot, called paraswift, by making it more robust for outdoor application and installing the corrosion detection technology onboard. The data is collected by the sensor and sent to a remote computer for analysis. In addition to this, a camera is also mounted on the robot for obstacle detection. The team hopes that the robot will be able to automatically identify obstacles in the future. The current version needs to be manually controlled. However, in future, autonomous navigation capabilities can be incorporated.

The technology behind the robot has been patented back in 2012. The technology transfer office of ETH Zurich is responsible for licensing the technology to companies. The team is currently working on upgrading C2D2 as well as working on the software for making it autonomous. The project is being funded by The Federal Roads Office (FEDRO) of Switzerland, which plans to use the robot for inspecting bridges.

Details: Bernhard Elsener, Lecturer at the Department of Civil, Environmental and Geomatic Engineering, ETH Zurich, Stefano-Franscini-Platz 3, 8093 Zürich, Switzerland. Phone: +41-44-633-27-91. E-mail: elsener@ethz.ch. URL: www.ethz.ch.

4. PATENT ANALYSIS OF GRINDING PROCESS

Grinding is a type of material removal and surface generation process that is employed for shaping and finishing of components that are made of metals and other materials. When compared to the other surface finish processes, such as turning or milling, the precision obtained through grinding process is said to be significantly high. In the grinding process, an abrasive product, which is usually a rotating product is brought into controlled contact with a work surface. The grinding wheel used in this process is composed of abrasive grains that are held together in a binder. These abrasive grains in the grinding wheel act as a cutting tool for removing the tiny chips of material from the work piece. As the abrasive grains wears out and becomes dull, due to the resistance between the grinding wheel and work piece thereby causing a fracture of the grains, which in turn weakens the bond of the grains. The dull pieces of the grinding wheel break away, revealing sharp new grains that enable further surface finishing of the component. Some of the commonly used materials for manufacturing the grinding wheels are aluminium oxide and silicon carbide. Aluminium oxide is primarily used for grinding components that are made of ferrous materials, and silicon oxide is used for grinding softer non-ferrous metals and high density materials such as cemented carbide or ceramics.

From the patents that are profiled in the exhibit, it can be seen that the current research activities are focused on developing the machines used in this process for improving the overall surface finish of the components and parts.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Process, grinding unit and production of a hydraulic binder	May 1, 20124WO 2014064243 A1	Lafarge	Didier Dumont, Mylène MARTIN	The present invention relates to a compression grinding process of at least one component of a hydraulic binder, said process comprising the compression of a bed of material (M) formed by this or these component(s) in a grinding zone (30), said process further comprising the addition of oil to the bed of material, via distribution means (66) located upstream of the inlet (32) to the grinding zone.
Method of maintaining a constant grinding process	October 2, 2012/US 8277285 B2	The Gleason Works	Brian J. Baldeck, Peter E. Chapin	Method of grinding cylindrical gears with a threaded grinding wheel wherein the amount of grinding wheel material utilized during shifting remains constant as the wheel diameter decreases, for example, due to dressing. The amount of grinding wheel shifting is adjusted as the grinding wheel diameter decreases.
Multilayer ceramic capacitor grinding process and application of multilayer ceramic capacitor grinding process	August 22, 2012/CN 102642170 A	Guangdong Fenghua Advanced Technology Co., Ltd.	Liu, encore wing, self-Chong Pang, Li Xiaoyu, Chenchang Yun, Jin border, yellow copyright, Huang Xu industry	The invention discloses a multilayer ceramic capacitor grinding process and an application of the multilayer ceramic capacitor grinding process A ground chip is a sintered ceramic front chip, the volume ratio of the chip to water to surfactants is (200-650):. (500-800): (5-20), and the operation curve is characterized in that the operation lasts 15 to 25 minutes at the rotation speed being 35 to 65 revolutions per minute (RPM), the operation lasts 15 to 25 RPM at the rotation speed being 55 to 85 RPM, and the operation lasts 110 to 150 minutes at the rotation speed being 110 to 150 RPM. The multilayer ceramic capacitor grinding process is applied to the preparation of multilayer ceramic capacitors, the traditional concept of grinding products after sintering is changed, the products are ground in advance after being cut, and the grinding is more easily than the grinding after the products are sintered into ceramics, so the grinding time is greatly shortened, and the production processing cost is saved; and meanwhile, the product quality is synthetically improved: the porcelain crack phenomenon is reduced, the impact force in the product grinding process is reduced, and internal micro flaws are reduced, so the insulation performance and the qualified rate of products are improved, and the product quality is improved.
Photoelectric device grinding process and device grinding process	November 25, 2008/US 7456051 B2	Advanced Semiconductor Engineering, Inc.	Kuo-Chung Yee, Chih-Lung Chen	A photoelectric device grinding process comprising the following steps is disclosed. A wafer comprising a plurality of chip units is provided. Each chip unit has at least a photoelectric device disposed on a surface layer. A dielectric substrate is attached to the wafer with glue having a plurality of spacers therein such that the photoelectric devices face the dielectric layer. The spacers maintain a gap between the dielectric substrate and the wafer. Thereafter, the dielectric substrate surface away from the wafer or the wafer surface away from the dielectric substrate or both is ground. The grinding process is particularly suitable for preventing any possible damage to the photoelectric devices on a wafer.
High smoothness grinding process and apparatus for metal material	October 17, 2006/US 7121928 B2	Nissan Motor Co., Ltd.	Kazuhiko Takashima	A high smoothness grinding process for obtaining a highly smooth surface of a metal material member. The process includes grinding an outer peripheral surface of a cylindrical or generally cylindrical metal material member by using a super abrasive grain grinding wheel in a condition in which a value [a peripheral speed of the grinding wheel/a peripheral speed of the metal material member] is not larger than 100, the grinding serving as a main grinding step.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Lens layout setting apparatus for lens grinding process and display apparatus for the same	October 25, 2005/US 6959227 B2	Kabushiki Kaisha Topcon	Hiroyuki Okada	A lens layout setting apparatus for lens grinding processing apparatus having a display screen of a display device for various settings for processing data of eyeglass lens shape for an eyeglass frame, and data of lens grinding process to grind the lens based on the data of lens shape for the frame, further including a control means to add, delete or rearrange a setting condition. The display device displays data of eyeglass lens shape for an eyeglass frame, and of eyeglass lens grinding process required for grinding the lens based on the data, and further displays tabs arranged to display a layout operating screen to set a layout of the data of lens shape for the frame, a state of measuring an edge thickness of the lens, simulation of the shape of a V-shaped protrusion formed on an edge of the lens, and a grinding process screen.
Grinding method and grinding machine	July 26, 2005/US 6921321 B2	Toyoda Koki Kabushiki Kaisha	Hiroshi Morita	In the grinding process, grinding fluid is supplied toward the grinding point where a workpiece is ground with a grinding wheel. At the same time, a fluid jet is ejected across the air flow above the grinding point in the rotational direction of the grinding wheel. As a result, the air layers on both lateral sides of the grinding wheel are turned not to head for the grinding point above the same, whereby the grinding fluid is reliably led to the grinding point without being obstructed by the air layers following both lateral sides of the grinding wheel.
Co-grinding process for the preparation of a ternary composition	February 23, 2005/EP 1507516 A1	Actimex S.R.L.	Tiziana Canal, Fabio Carli, Mora Paolo Corvi	A ternary composition comprising an active substance, a hydrophilic or hydrophobic carrier and a co-grinding auxiliary substance and a process for the preparation thereof by the co-grinding of the three components, in which said process allows operating with drastically reduced co-grinding times with respect to the known art and to obtain ternary compositions in which the active substance shows characteristics of amorphisation, solubility and dissolution speed as requested for the various uses.
Grinding process for plastic material and compositions therefrom	October 2, 2003/ WO 2003080715 A1	Procter & Gamble	William Maxwell Allen Jr, Isao Noda	The present invention relates to a process for grinding a plastic material to produce superfine particles and compositions, such as suspensions and dry powders, resulting from such process. Common ice is the abrasive for grinding.
No coat backside wafer grinding process	May 27, 1997/ US 5632667 A	Delco Electronics Corporation	Michael R. Earl, Russell A. Detterich, Robert A. Yancey	A silicon wafer grinding apparatus for grinding a backside surface of a semiconductor wafer that includes integrated circuit chips patterned on a frontside surface of the wafer. The apparatus includes a plurality of chuck tables that secure a plurality of wafers to be ground. Each chuck table includes a cushioned rubber pad secured to the table and an interface with the frontside surface of the wafer. An organic acid cooling fluid is utilized during the grinding procedure to prevent silicon particles and residue from being adhered to the metal bond pads of the integrated circuit chips.

Exhibit 1 depicts patents related to grinding process.

Picture Credit: Frost & Sullivan

Back to TOC