TECHNICAL INSIGHTS

ADVANCED MANUFACTURING

TECHNOLOGY ALERT

28th August 2014

1. METHOD FOR TESTING MATERIALS AND COMPONENTS AT A FASTER RATE

Ultrasound is an established method for testing components, structures, and materials in diverse industries, such as aerospace and automotives. It can determine internal or surface defects, or characterize metals or other materials such as concrete, wood, or composites. The drawback with the ultrasound method is the amount of time taken for evaluating the data obtained from this testing method.

Researchers from the Fraunhofer Institute for Nondestructive Testing, IZFP, Germany, have developed an innovative ultrasound testing method for testing materials at a significantly faster rate with the help of 3D images. In the ultrasound testing method, the ultrasonic waves are emitted from a probe which is used for detecting the minute tears and other flaws in the materials, which are not visible externally. Historically, employees have been used for guiding the probe along the component by hand, with the reflected signals appearing in the form of curves on the display of the probe. This method can be highly efficient for examining the areas of materials and components having a simple cross section. However, with complex materials and components, this method can become highly time consuming and complicated.

The method developed by the researchers from Fraunhofer uses a phased array technology, which has several single element probes arranged adjacent to each other in two rows of sheets. This allows the ultrasonic waves to pass through large areas of material at a single time instead of penetrating through the component being tested selectively. The innovative arrangement of the probes also allows the user to control each probe individually, thereby allowing the user to focus on all parts of the area that are being tested simultaneously.

The researchers have also developed a novel algorithm that is capable of generating 3D images from the various individual signals which can be viewed using a computer. According to the researchers, the three-dimensional images obtained from this method are significantly better than the conventional methods. The algorithm also helps in obtaining real-time images of the component being tested, thereby reducing the time taken for testing. As this process is robot assisted, it can be used for testing materials that are difficult to test using conventional methods. For instance, testing of fiber reinforced high-performance polymers with a direction dependent fiber orientation is an novel application that can be implemented using this new method. While analyzing abnormalities in the materials, the examiner would be able to view the pictures from different directions and orientations and also select the specific areas. In industrial applications, essentially automated component testing could be achieved by having a robot that is connected to the inspection system through an interface to carrying out the complete scanning of the components. The 3- dimensional views generated can then be automatically evaluated using the algorithms that have been developed, which makes the process less time consuming and more reliable. In addition to material testing, this method can also be used for the entire life cycle of the product, such as characterization of the material to evaluation of component parts and for repair and recycling. The researchers are currently working on qualifying this method, which is expected to be commercialized soon.

Details: Dr. Hans-Georg Herrmann, Professor, Fraunhofer Institute for Nondestructive Testing IZFP, Campus E3 166123 Saarbrücken, Germany. Phone: +49-681-9302-3820. E-mail: hans-georg.herrmann@izfp.fraunhofer.de. URL: www.fraunhofer.de.

2. ROBOTIC DEVICE FOR UNDERWATER APPLICATIONS

Robots are being adopted in a wide range of industrial sectors and applications these days. For example, in manufacturing, mobile robots have been proliferating in such applications as warehousing and distribution, painting/de-painting. With each day, there is a new potential application area for robots. One such novel application is for the use of anchoring of sea vehicles. Researchers

from the Massachusetts Institute of Technology (MIT) have developed a device to carry out the above-mentioned task.

Indicative of the new and expanding opportunities for robots, the RoboClam robot device, developed by researchers from MIT, USA, is designed to be able to dig itself into the ground or bury anchors or even destroy underwater mines. It uses localized fluidization to attain the capabilities of a digging clam. While developing an anchoring system that utilizes significantly less energy, the researchers first built a mechanical puppet clamshell that consisted of two halves and was capable of moving together and apart in a coordinated manner. This puppet clam was then connected to a rod which could open and close the shell in addition to pushing it up and down. In order to test their RoboClam, prototype the researchers used a compressed air system for powering the expansion and contraction of the shells.

They are now working on developing an electronic version of the robot device that could be compatible for use in underwater vehicles that is being developed by Bluefin Robotics, which is an MIT spinout company based in Quincy, Massachusetts. Bluefin Robotics has been the sponsor for this project. During the initial stages of this project, the researchers wanted to develop a device for anchoring autonomous underwater vehicles to a seabed or riverbed without consuming significantly large amounts of energy. As robotic vehicles have a limited amount of battery power, an anchoring system consuming less energy could be useful for extending the vehicle's operating time. The RoboClam device could be used for anchoring sea vehicles that are made to stay stationary for a long time when they are being deployed for monitoring biological situations and military purposes. By employing this device, the sea vehicles would be able to save a lot of power. In addition to being used for anchoring purposes, the RoboClam can also be employed for detonating mines, thereby reducing the risk to human lives in these dangerous situations. RoboClam can also be used for laying underwater cables. For instance, for laying trans-Atlantic cables, companies have traditionally used a ship to drag a sled along to the bottom of the ocean and dig a trough to lay the cables. When the depth is around 10 meters or less, it is difficult for the ships to operate. In such cases, the work is done manually by humans, which is both time consuming and expensive. By employing a device such as RoboClam, this operation can be carried out at a significantly

faster rate as the device automatically digs into the soil and performs the operation.

Due to the above-mentioned advantages and potential applications, this device would be adopted on a large scale once it is commercially available in the market.

Details: Helen Knight, MIT News correspondent, MIT, 77 Massachusetts Avenue, Cambridge, MA 02139-4307. Phone: 617-253-2700. E-mail: helenk@mit.edu. URL: www.mit.edu.

3. NOVEL MATERIAL FOR MANUFACTURING SOLAR CELLS

Sustainable or green manufacturing products and methods have been increasingly gaining adoption in recent years. This is largely due to government initiatives to reduce pollution and also to conserve natural resources. Solar cells are one such example of a green sustainable product that has gained a significantly high adoption rate, but the drawback seen with the existing solar cells are that they are expensive. Researchers from Nanyang Technological University (NTU), Singapore, have developed a novel material for manufacturing solar cells at significantly less cost.

The novel solar cell material has the ability to emit light in addition to converting the captured light into electricity. The novel material used in this innovation is Perovskite, which is seen to have potential in terms of producing high efficiency, inexpensive solar cells. These novel solar cells glow when the electricity passes through them and also these colors can also be customized. This latest innovation by the researchers has been published in the February 2014 edition of the journal *Nature Materials*. The ability of these novel solar cells to glow when a laser beam was passed through it has been seen as a major breakthrough in the materials being used for solar cells since most of the solar cells materials do not generate light. This highly luminescent characteristic of this novel material has made it suitable for the manufacturing of lasers.

The significantly high quality of the material and the durability it possess under exposure to light, makes it possible for these materials to capture the light particles and convert them into electricity. By tuning the material composition, it would be made possible to emit a wide range of colors, thereby making it suitable for producing light emitting devices such as flat screen displays. Researchers believe that this newly discovered property of the material helps the industries to adopt the material into their existing technologies and products. This versatile and low-cost material would have a significantly high advantage for green buildings. As the researchers are currently working on scaling these materials for large-scale solar cells, it would be easy for them to fabricate light emitting devices. The initial workings of this project were first published in a leading scientific journal Science in October, 2013. The researchers of NTU have already applied for a patent for this novel material and are now waiting for the approval. The solar cells made using this new material are said to be five times cheaper than silicon-based solar cells that are currently available in the market. The reason for the low cost of this material is due to the simple solution-based manufacturing process, which involves the combining of two or more chemicals at room temperature. This project has been funded by the NTU and the National Research Foundation (NRF) Prime Minister's Office, Singapore, under its Campus for Research Excellence and Technological Enterprise (CREATE) programme.

Some of the advantages of this novel material are that it can be used for manufacturing solar cells that are significantly lower in price than the existing products currently available and also the potential for use in a wide range of application sectors. This innovation is expected to be adopted on a large scale for manufacturing solar cells once it is commercially available in the market.

Details: Lester Kok, Senior Assistant Manager, Corporate Communications Office, Nanyang Technological University, 50 Nanyang Avenue, Singapore. Phone: 6790 6804. E-mail: lesterkok@ntu.edu.sg. URL: www.ntu.edu.sg.

4. PATENT ANALYSIS OF BI-INJECTION MOLDING PROCESS

Bi-injection is one of the earliest forms of multi-material molding and unlike co-injection and sandwich injection molding, does not produce parts in which a core material is contained within a separate skin material. Instead, in the bi-injection molding process, both materials are visible in the finished part. In this molding process, two different types of resin materials are simultaneously injected into different ports of the same mold that is used for manufacturing the product. As the materials are made to flow into the mold, they are made to combine with each other at a common interface where it is cross polymerized. The Bi-injection is relatively simple in operation and is predominantly used for producing simple and low-tolerance products. The cross interface is naturally formed when the two different types are made to meet a significantly simple planar surface. Some of the common application sectors for this molding process are automotive and consumer products, such as mobile phones and so on. Plastic products are most commonly manufactured products using this process. Some of the advantages of the bi-injection molding process are that it has significantly high efficiency and it is very simple to use.

From the patents that have been exhibited, it can be seen that the research has been carried out to increase the range of products that are being manufactured using this molding process and also in the parts and components that are being used in bi-injection molding machines.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Applications for improving flair preform	December 18, 2013/ CN 103459111 A	Allocation Technology Co., Ltd.	W · J · J · Maas, P · L · W · Hulk Mansfield, A · S · Hale Wa	The present invention provides an improved preform Flair and Flair applications for. In an exemplary embodiment of the present invention, if not joined together using two different materials to manufacture the preform, the mold can be manufactured using the same preform by this bi-injection process. In this exemplary embodiment, the first pre-forming the outer shape of the molded member, and then through the central bore provided on the outer bottom of the preform to preform mold system. Then, the two are connected to each preform. The two materials may be different, e.g., PET and a polyolefin or polyamide, or even for example they may be the same, e.g., PET / PET, as long as the measures taken during the second layer of the preform molding to prevent their link. In such a process, can be located in a non-sticky coating on the surface of the injector between the preform, where the preform of the second preform in contact first, and after the application, the process can also 2C the molding of the second container. In various exemplary embodiments, the order may be manufactured inside the first, the first inner or outer post. If within the first outside, the outside of the first pre-injection molded on the inside of the non-adhesive coating of the molded article after the molded preform. If, by contrast, in the first pre-injection-molded on the outside of the non-adhesive coating of the molded article, after molding the outer preform. For a given application may be, uses, or use of materials used to make the design of the inner container, with respect to the degree of shrinkage of the outer container is subjected to a maximum temperature of hot filling and can withstand the accompanying.
Double-Layer Injection Molding Casing and Method for Manufacturing the Same,Electronic Apparatus	February 14, 2013/ US 20130038992 A1	Hisense Hiview Tech Co., Ltd.	Dejun Wang, Wangjun Zhang, Haode Jiang	A double-layer injection molding casing and a method for manufacturing the same, an electronic apparatus are provided by this invention, which adapts to an injection molding field and can solve the problems of a conventional double-layer injection molding casing such as complicated manufacturing process and low production efficiency. The double-layer injection molding casing of this invention includes an outer layer and an inner layer. A locating structure integrally formed with the inner layer is located at an inner surface of the inner layer. The method for manufacturing the double-layer injection molding casing includes: applying a multiple injection molding process, wherein the locating structure of the double-layer injection molding casing is integrally formed with the inner layer in the same injection molding step. The electronic apparatus of this invention includes the double-layer injection molding casing. The double-layer injection molding casing can be used as a casing of the electronic apparatus.
Cross-member module for a motor vehicle	October 19, 2011/ CN 102219030 A	LANXESS Deutschland LLC	Ulrich Daye Ke, Thomas Malik, Boris Koch	he present invention relates to a transverse-member motor-vehicle module for receiving the instrument panel and reinforcing the bodywork for the direct connection of the two A-pillars of a motor vehicle, composed of a transverse member with a steering-column retainer, where the transverse-member module, i.e. not only the transverse member but also the steering-column retainer, are manufactured using a metal-plastic-composite design (hybrid technology), and these are composed of at least one main body and of at least one first thermoplastic part and one second thermoplastic part, where these have been securely bonded via injection moulding firstly to the main body and simultaneously the various plastics parts have been bonded to one another, where the two plastics parts are composed of different plastics materials and these are injected in the bi-injection moulding process, where they fuse with one another when they encounter one another.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Cosmetic applicator assembly	April 13, 2011/ CN 102014691 A	Elc Management LLC	C · Jacob, H · F · Buyi Wa	A cosmetic applicator assembly, which includes a polymeric brush and a twisted wire brush. Specifically, the polymeric brush comprises an elongated polymeric core and multiple polymeric tines protruding from the elongated polymeric core. The elongated polymeric core comprises a first polymeric material of a first tensile modulus, while at least some of the polymeric tines comprise a second polymeric material of a second tensile modulus that is smaller than the first tensile modulus. The twisted wire brush comprises a metal wire core and multiple bristles protruding from the metal wire core. The elongated polymeric core of the polymeric brush is complementarily engaged with at least a portion of the metal wire core of the twisted wire brush to form the cosmetic applicator assembly. The polymeric brush of the present invention is preferably formed by a bi-injection molding process.
Double-sided and bi-color internal injection molding method and injection molding panel	November 4, 2009/ CN 101570066 A	Haier Group Company; Qingdao Haier Air Conditioner Corporation Limited	Wu Liqin, Yaoqi Yuan, Zhang Shouxin, Lei Li, Yong Wang, Wang Youning	The invention relates to a double-sided and bi-color internal injection molding method and an injection molding panel. The injection molding method comprises the following steps: printing required patterns and/or colors on a membrane by adopting a silk-screen printing process, preserving a display window on the local part of the membrane, preparing a membrane A after being dried, preparing a membrane which is fused with injection molding materials into a semitransparent membrane B provided with a mirror surface by adopting an electroplating process, cutting the membrane A and the membrane B into required dimensions and shapes by using a punching mold, pressing the membrane A in the shape of a flat plate into an actually required shape by adopting a mode of hot-plate profiling or high-pressure forming, placing the membrane A and the membrane B after forming into a male mold and a female mold of an injection mold respectively, positioning the membrane A and the membrane B through a membrane positioning device which is arranged inside the mold, performing injection molding on a cavity of the mold in which the membrane A and the membrane B are placed, and taking out an injection molding piece after forming. The invention has the advantages of eliminating black spots and impurities caused by printing on the surface of electric appliances and avoiding air bubbles caused by a membranesticking method.

Title	Publication Date/Publication Number	Assignee	Inventor	Abstract
Bi injection moulding process for producing hollow plastic automotive parts by using a rotating die apparatus	December 6, 2002/ CA 2147458 C	Plastal S.p.A.	Maurizio Geremia	Bi-stage moulding process of plastic in the automotive, with rotating die apparatus for hollow plastic products of big section, in which the bi-stage moulding process of a product includes a second working stage, where the plastic moulding cycle with gas assisted injection is performed, which is performed under the skin with respect to the element of partial aesthetic coating of the product, said element of partial aesthetic coating being obtained in a previous working stage including a first plastic injection moulding cycle.
Finger-operable pump actuator with finger pad	February 22, 2006/ US 6401990 B1	Seaquist Closures Foreign, Inc.	Peter J. Walters, David Moore	A finger-operable pump actuator is provided with a generally rigid body and a softer finger pad on top. The generally rigid body and the softer pad are preferably bi-injection molded together. The actuator may be bi-injection molded in a variety of aesthetically pleasing designs.
Trigger spray nozzle cap fabricated by bi-injection molding	June 11, 2002/ EP 1457265 B1	Saint-Gobain Calmar Inc.	Steve L. Sweeton, Philip J. Dimaggio	A nozzle cap of a trigger actuated pump sprayer is produced of two different materials using a bi-injection molding process for delimiting the markings on the outer faces of the four walls of the cap serving as indicia relating to specific rotative positions of the cap.

Exhibit 1 depicts patents related to bi-injection molding process.

Picture Credit: Frost & Sullivan

Back to TOC