TransReflection

3D Printing Set to Revolutionize Industrial Printing Processes: The Rewards and the Risks for Re/insurers

LinkedIn Intro:
"3D printing offers enormous potential for manufacturing innovation. Rüdiger Skaletz, TransRe Europe's Head of Marketing and Munich Branch Manager, explores the opportunities and potential risks inherent in this newly emerging risk for re/insurers."

The first consumer 3D printer was introduced by Adrian Bowyer in 2004, after certain fundamental patents on pre-existing industrial printing processes expired. Called RepRap, it is still around today. The benefit of RepRap machines is that they are self-replicating. The parts needed to build the RepRap 3D printer are all capable of being 3D printed on a similar RepRap machine. It's essentially a build-your-own 3D printer. By 2014, the 3D printing industry posted revenues of more than US$2 billion, up from less than US$1 billion in 2009. Today, sales related to 3D printing by large public companies including enterprise 3D printers, materials and services will surpass US$2.7 billion (2019). It is projected to top US$15.8 billion in 2020, according to Forbes.

Growth Accelerated with Availability of More and Diverse 3D Printing Materials

One of the big reasons for the accelerated growth in 3D printing is the availability of more and diverse 3D printing materials. In 2014, the list of materials that could be used in 3D printing was already long. Today, in 2019, the list of possible 3D printable materials has expanded to more than double what it was 5 years ago, with mixed material printers becoming more common. Today, 3D printers are now able to print with more than one material. Additionally, there has been a shift away from plastic toward metal printing. While plastic is still the most common material, its share in 3D printing is about 65%, down from 88% in 2016. In the meantime, metal printing rose from 28% to 36%. At that rate, metal will overtake plastics and represent more than half of all 3D printing as soon as 2020 or 2021. While plastic is fine for prototypes and certain final parts, the trillion-dollar metal parts fabrication market is probably the more important market for 3D printers to address.
(CHART:)

Top 10 Printer Materials for 3D, 4D and 5D Printers

- Sintered powered metal
- Metals such as stainless, bronze steel, gold, nickel steel, aluminum and titanium
- Carbon fiber and other composites
- Carbon nanotubes and graphene embedded in plastics
- Nitonel
- Water-absorbing plastic
- Stem cells
- Paper
- Concrete, food, yarn

List of 3D Printed Products Expands Exponentially

Today, 3D products are available in construction, automotive, weapons, aviation, aerospace, medical, clothing and even food. For example, a new, 3D-printed house can be built in less than a day for just $4,000. An electric car priced at $7,5000 is due to hit both the Asian and European markets in 2019. It takes 3 days to 3D print all the interior and exterior components for the LSEV car, excluding parts like tires, windows, seats and chassis. Working guns are now being made with 3D printers, titanium aerospace components are being 3D printed and tested, spare parts are being printed at the International Space Station from a 3D printer. Some of the more promising and surprising uses of 3D printing are in the medical and bioprinting field.

These products include 3D-printed arm protheses, jawbones, bionic eyes, skin and tissue. The bioprinting and medical area also uses 3D printers for reproducing organs like the liver, heart and pancreas. The procedure for 3D printing of a pancreas involves stem cells which are bred into polymeric gel, and then the tissue is structured into an organ.

The Technology Behind 3D Printing

Computer Aided Design (CAD) system software creates a 3D design of the product. The final design is converted to an electronic format readable by the 3D printer. Then materials that will become the 3D objects are manually or automatically loaded into the 3D printer. The 3D printer receives the electronic file, the object is automatically dispensed or removed by hand, and the product is refined into precise shape. Essentially, the 3D printer takes the amount of material needed and shapes it as desired. Sometimes, a block of too much material is used. After printing, whatever is not needed (subtractive manufacturing) is removed. In other cases, the material is built up bit by bit over time using the material until the designed part is finished (additive manufacturing).
(CHART: Traditional vs Additive Manufacturing Supply Process, from PPT)

Enterprise Motivation

3D printers are getting much faster and their build-volume – the printable objects' size – is getting bigger. Many large companies have entered the 3D printing market in a highly strategic way, using 3D printing to improve part performance in interesting ways, such as printing lighter-weight parts, gaining more flexibility in manufacturing, simplifying components and so on. In addition, 3D printing is providing numerous opportunities to develop customized products, add new revenue sources and create new items that would be impossible using traditional methods.

(CHART: Enterprise Motivation, from PPT)

The Re/insurance Implications

As with any technology, benefits need to be balanced against risks. The risks of 3D printing can be classified by stakeholder group – raw material suppliers, intermediate and finished goods manufacturers, software and hardware developers, workers, consumers and communities.3D printing risks generally revolve around design and intellectual infringements, the quality of raw materials, the new combination of raw materials not yet tested, employee liability risks and multi-jurisdictional risks when products are distributed on a worldwide basis.

Underwriting these risks can be daunting because loss experience is still very limited. Questions that arise for underwriters include:

- Should machines be equipped with automatic power shut-off components and fire suppression systems?
- Are protection measures adequate in respect to the flammability of plastic components?
- The machines are prototypes – how long will it take to replace them? Is the storage of raw materials adequately protected?
- Further considerations for underwriters include:
- Are employees of the company trained in use of chemical hazards and safeguards?
- Is the electrical equipment approved?
- Is the wiring and equipment suitable for a hazardous location?
- Is there a danger tag system in place in potentially explosive areas?

Recent studies show that the 3D production process releases nanoparticles and other toxic materials into the air. The time needed for the nanoparticle concentration in the air to go back to standard levels was between 10 and 30 minutes after the extrusion processes stopped. The absorption of toxic volatile organic carbon (VOC) and nanoparticles can cause pulmonary pathologies such as bronchitis, tracheitis and asthma. In some cases, these substances also cause certain types of cancers. Insurance coverages that many be impacted by 3D printing include Professional Indemnity, Product/Public Liability, Machinery Breakdown, Employer's Liability, Property/Business Interruption Insurance, D&O Insurance, Aviation and Marine Insurance and Medical Malpractice. Specifically:

General Liability – Inadvertent infringement could rise as employees are able to download component parts from the Internet and integrate them into new products, bypassing traditional procurement and contracting routes

Product Liability – Potentially long-tail liabilities could arise from flaws in 3D printing techniques or deficiencies in the new materials.

Professional Liability – Digital 3D models are distributed across the globe and interpreted by a wide variety of printers, all configured and calibrated differently. Product related lawsuits could become complicated by arguments over contribution between designers, printing machine manufacturers and end users.

Additional issues arise from traceability and supply chain issues, regulatory action (retailer, designer, manufacturer) if safety breaches occur, and how do you determine the contributions made between parties? If fewer are involved, fewer can share the burden of any damage.

Underwriters can respond to these risks by:

- Encouraging use of reputable designs
- Encouraging sensible use of disclaimers
- Enquiring as to the insured's quality assurance
- Asking about safety and hazard controls for 3D printing activities
- Understanding the insured's business
- Consider carefully the questions asked both at inception and renewals
- Judicious use of warranties and conditions precedent
- Learn about jurisdictions in which the insured operates (including regulatory risks)
- For many insureds, a shift to 3D manufacturing may be a business operating drift, which can result in loss of coverage (risk for SMEs)
- Emphasize strong contractual relationships

Finally, it should be noted that 3D printers aren't the end of the line. There are also 4D and 5D printers. 3D printers create objects layer by layer. This is particularly useful in prosthetic/medical implants, making spare parts at the International Space Station, creating firearms, contour crafting for construction and parts for aviation, marine and offshore activities. 4D printing or fourth dimension printers include a time element. The object varies form when affected by water, temperature, vibration and pressure. This type of printer is used in water pipes, furniture, biodegradable products and implants.5D printers use a 5 axis as there is no fifth dimension. This printer increases strength, reduces weight and material consumption. The outlook for 3D, 4D and 5D printing is still at an early phase, but now is the time to think about the risks and how to address them.

To learn more or to join the discussion around 3D printing, contact Rudiger Skaletz, SVP & Branch Manager, Chief Marketing Officer, TransRe Europe, T: 49 89 45237 7911 direct or rskaletz@transre.com.