Additive Technologies Focusing on Industrial Applications for Metal and Plastic Parts

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The processes of additive manufacturing (AM) are known since the late eighties of the last century with the advent of stereolithography and have been used for the fast production of prototypes, known as rapid prototyping. At this time, these production techniques were more relevant for scientific research than for production. As it is possible to fabricate parts without any tool directly from CAD files, these rapid or 3D printing technologies were established in prototype departments of different industrial branches. Due to their layered structure, there are even fewer restrictions for design and many more possibilities for sophisticated structures. It is possible to manufacture complex and functional systems in one piece without requiring any assembly afterwards. As increasing competitive pressure (e.g. in automotive industry) results in more and more niche products with small lot sizes, additive technologies are entering series production to avoid investment costs, react quickly to new trends and enable individualization. In using additive technologies the industry is able to react on product changes in an economic manner.

The impact of AM continues to grow, in terms of the total number of parts generated, the number of machines sold, and the amount of scholarly activity in the form of publications and patents.

Additive manufacturing technology cuts across a large number of industries and applications, and that is part of what makes its potential so compelling. Aerospace, automotive, medical and consumer products will drive AM into the future. From these core industries alone, vast amounts of research and investment will propel AM technology to new heights. Other industries, including the military, dentistry, jewelry, video game avatars, collectables, construction, furniture and home accessories and toys, will also play an important role in the future development of AM technology and its application.

At BMW many prototypes are manufactured by means of additive technologies, for the purpose of geometrical and functional safeguarding within the development process.

Today, the most important technologies for processing plastics are: Stereolithography (SL), Laser sintering (LS), Fused Deposition Modelling (FDM), and 3D Printing (3DP or inkjet printing). Stereolithography works by using a UV-laser which initiates a cross-linking

reaction of a photopolymer. The use of this technology is restricted due to the toughness of the parts. However, nowadays over 1000 hearing aid housings made of stereolithography resins are being sold every day. During laser sintering, loose powder is selectively melted or sintered by a focused IR-Laser. Today, almost dense parts with mechanical properties on a high level can be produced through advancements in the process. Fused Deposition Modelling (FDM), is mostly used for big parts. The 3D-Printers were only designed for optimum accuracy, speed and costs up to now. Concerning this process (3DP), mechanical properties are less important.

Concerning metal parts, Selective Laser Melting (SLM or Laser Cusing) is diffused mostly. With this technology, a laser fuses a metal powder to create parts. Instead of a laser, it is also possible to employ an electron beam (EBM).

In automotive industry, all of these techniques are implemented as a huge variety of different parts with different property profiles has to be produced.