

# The development of the 3D printing technology in the Radom region

Rozwój technologii drukowania 3D w regionie radomskim

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The paper presents the benefits of using 3D printers in industry. It has indicated the possibility of the development of 3D printing technology and discusses ways of using 3D printing technology to the Radom region in relation to global trends and also outlines the prospects for this region.

**KEYWORDS:** 3D printing, use, perspectives

The engineering industry in the Radom region largely does not produce its own products but provides services to other companies. Production, currently based mainly on CNC machines, is based on the technical documentation provided by the contracting authority. It is therefore a low level of innovation.

In order to gain access to innovative technologies, to expand international cooperation, and to raise the EU funds, it is necessary for the local metalworking industry to exchange machine stock for 3D printers. After implementing a new technology, i.e. 3D printing, cooperation should be established mainly with the aerospace, defense and medical device industries.

## 3D printing technology

3D printing technology, due to the wide range of materials used, offers more possibilities for machine parts than machining on numerically controlled machines. The machine parts should have a high degree of performance and durability. This problem with regard to 3D printing technology is widely presented in publications, e.g. [1, 2, 3, 4].

The 3D printing is applicable in many areas. Due to the use of this technology in architecture, detailed mock-ups of buildings can be created. In medicine, it is possible to create implants designed individually for each patient, used during operations of skulls and faces of people who have suffered serious head injuries or patients with congenital deformities. Dental laboratories can eliminate the inconvenience of manual modeling. In the production process, thanks to 3D printing technology, molds can be produced in a short time.

## 3D printing technology in the Radom region

Given the growing market share of 3D printing technology and the optimistic growth forecasts for this segment in the coming years [5], it is imperative to disseminate current knowledge about 3D printing technology among employees and management boards of local industry. In the Radom region, 3D printing technology is already in the interest of entrepreneurs. The location of regional metallurgical companies near the airport in Radom, which offers fast transport, is also of some importance. This gives the opportunity to immediately deliver parts made using 3D printing technology, such as medical implants.

### ■ Radom Center for Innovation and Technology.

Radom Center for Innovation and Technology is a company established in December 2012 by the Industrial Development Agency to build a Science and Technology Park. One of the departments of the emerging Science and Technology Park and the national network of pro-innovation institutions will be the Innovation Center Laboratory. Material, technology and machineries laboratories equipped with state-of-the-art machinery and equipment, including the 3D Print Center will be in the center created structure. The center will focus companies operating not only in Poland, but also abroad.

■ **Radom Metal Cluster.** The beginning of the joint operation of the Radom Metal Cluster was given way to signing of the "Cooperative Metal Industry Agreement" in 2011 [6]. The cooperation agreement was signed by 13 companies and institutions. The basic purpose of the signatories of this agreement is to change the image of Radom metal industry, to show its production and service potential and to implement modern technologies. In the development strategy of the Radom Metal Cluster, the main objectives of the activity were to gain access to innovative technologies, to expand international cooperation and to raise EU funds. These goals will be achieved by making a smooth replacement of a machine park based on CNC machine tools producing products both made of plastics and metal powders. After

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deployment of 3D printers for production, the cooperation offer will be directed mainly to the aerospace and defense industries and to medical device manufacturers, including implants.

#### ■ UTH Mechanical Engineering Faculty in Radom.

The mission of the Mechanical Engineering Faculty of Radom is, among others, to play the role of a scientific and educational center that creates innovation and modern technical solutions in the engineering environment in cooperation with local economic units. For many years, the Mechanical Engineering Faculty has conducted scientific work on the issue of 3D printing. In 2013, a 3D Printing Team was set up to assist in the exchange of metal-based machine tools based on CNC machines, on 3D printers in the local metalworking industry. The team organizes meetings with representatives of 3D printer manufacturers and representatives of companies and research centers that use 3D prints as well as scientific lectures. In addition, it consults on 3D printing technology and submits proposals for joint grants.

■ **ATS consortium.** The ATS consortium develops and manufactures electronic and mechanical components for a variety of applications based on its own solutions, including 3D printing technologies. The three main streams of this company include computer network products, products for the generation and distribution of renewable energy and energy-efficient light sources. The consortium also offers components for 3D printers and consumables. The consortium is also able to make a complete 3D printer according to the individual needs of the recipient.

### Scientific activity in 3D printing technology

At the Faculty of Mechanical Engineering at UTH Radom, research is conducted upon the possibilities of applying 3D printing technology to the production of functional parts of machines, based on the analysis of the stationary life of printed gears. In conjunction with the scientific work at the Faculty of Mechanical Engineering, meetings are held with representatives of 3D printer manufacturers and companies and research centers that use 3D printing technologies as well as scientific lectures and consultations on 3D technology. So far, there has been a meeting with a representative of the German company EOS producing 3D printers and a representative of Materialise company specializing in software development for 3D printing technology in medicine.

### Opportunities for 3D printing technology development in the Radom region

Prospective action for the Radom region could be the introduction of copper powder as a material for 3D printing technology. Similar research has been made with a measurable success in South Africa with regard to the use of titanium powder as a 3D printing material. Today, copper as a material in 3D printers is used sporadically, despite favorable properties, among others, good conduction of heat and electricity. This venture can be sponsored by KGHM Polska Miedź. An important element of this activity may be the specialization of

companies belonging to the Radom Metal Cluster in the manufacture of parts of copper powder machines.

However, realization of such a vision is associated with numerous scientific problems that still need to be solved, due to the strong copper heat dissipation. First and foremost, the spherical microcrystalline copper must meet the requirements of 3D printers. Then one needs to match the performance of 3D printers with this material. The 3D printers used for this purpose should be equipped with energy sources (lasers or electron guns) with a much higher power than those previously used.

The use of copper powder as a material in 3D printing technology will open the Metal Cluster's prospects for the entry into the market of modern and innovative technologies. Leading 3D printing companies, such as EOS GmbH and Arcam AC, may be interested in copper as a material, since it will significantly expand the range of materials used in their 3D printers.

### Conclusions

There are a number of medium-sized, dynamic companies using modern technologies in the Radom region. However, in the industry of Radom region, 3D printing technology is not yet implemented, although there is a real possibility for the 3D printing center to provide services for the region. The 3D Printing Team, operating within the UTH Mechanical Faculty in Radom, is prepared to support entrepreneurs in Radom region within the implementation of 3D printing technology.

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