Секция 2. МЕТОДЫ ИССЛЕДОВАНИЙ И МЕТРОЛОГИЧЕСКОЕ ОБЕСПЕЧЕНИЕ ИЗМЕРЕНИЙ

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STANDARDIZATION OF 3D PRINTING

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Additive manufacturing (or three-dimensions printing) is the process for making three-dimensions objects of any shapes from the basis of the digital multi-dimensions model or other electronic data source through additive processes in which successive layers of material are laid down under computer control.

AM technologies found applications starting in the 1980s in product development, data visualization, rapid prototyping, and specialized manufacturing.

Although this technology exists since the 1980s, it has developed only since the 2010s. So we can say, that this technology is new for us.

This industry developed slowly until nowadays. Industrial production roles within the industries achieved significant scale for the first time in the early 2010s. Since the start of the 21st century there has been a large growth in the sales of AM machines, and their price has dropped substantially.

Nowadays 3D printing technology has been successfully used in many fields of science or others. For example in the construction and building field it is possible to print building blocks for houses or other construction, in medicine now it is possible to print human tissues to replace diseased one.

Applications are many, including architecture, construction, industrial design, automotive, aerospace, military, engineering, dental and medical industries, biotech, fashion, footwear, jewelry, eyewear, education, geographic information systems, food, and many other fields.

However 3D manufacturing isn't industrial only in our days. We can also use it for personal needs, because many companies develop home-version 3D printers.

Implantation of the technology occurs rapidly, and in the result the technology is fast developing now.

Of course, according to foresaid the technology needs in correct standards, but some problems and unsolved questions exist in this field.

Different organizations of standardization solve some problems of it.

The EU project SASAM, the Support Action for Standardisation in Additive Manufacturing, has delivered a.o. a Roadmap for standardisation activities.

This Roadmap document is open to the AM community for review in order that all relevant stakeholders have the opportunity to express their suggestions for improvement, identify other essential recommendations or provide general comments. This input will be progressed and will result in a next version of the Standardization Roadmap.

SASAM project is quite advanced and, consequently, the first standards on AM are being established by the working groups (WG) created by the project: terminology, materials and processes and tests methods.

Operating under the IEEE-ISTO is the Printer Working Group (PWG). Aware of the growing popularity of 3D printing, the PWG sent an action item to their Semantic Model Work Group to reach out to 3D printer manufacturers and make them aware of the work the PWG has done. The PWG has been dealing with networking printers for some time and believes that their PWG Semantic Model could help 3D printer (and device) manufacturers properly anticipate some of the problems with networking printers.

In other words, a 3D printer printing over a network may be read differently by a piece of software than a 3D printer connected directly to a computer.

The European Committee for Standardization (CEN) goes about deciding standards within various industries, the Support Action for Standardization in Additive Manufacturing group gets into the gritty of AM.

Working with standards organization ASTM International and the CEN, SASAM is hosting a number of conferences in the world of 3D printing to get together and make sense of everything in tediously explicit detail so that, if ever there's a question about what a term means or how a process works.

A memorandum of understanding (MOU) agreement with ASTM International to develop standards for the AM community in the United States of America.

At the international level at the moment standardization additive manufacturing technologies

involved in ISO / TC 261 "Additive Manufacturing".

Canada is one of 18 countries involved with the ISO/TC 261 international standardization committee on additive manufacturing, set up in 2011 by the International Organization for Standardization (ISO).

The quickly changing nature of these activities has shown a need for standards governing a number of aspects, including terms and definitions, process chains (materials and software), testing procedures, quality parameters for primary materials and end products, and other basics. Canada mirror committee members will be able to follow, comment on, and influence standardization projects and proposals made by the international committee. They can do this on the Canadian e-forum provided by the Standards Council of Canada, allowing for opinions, concerns, and positions of Canada mirror committee members to be forwarded to the ISO/TC 261 international committee.

This document contents:

- ISO/TC 261/JAG. ISO/TC 261 - ASTM F42 Steering group on JWG activities;
- ISO/TC 261/WG 1 Terminology;
- ISO/TC 261/WG 2 Methods, processes and materials;
- ISO/TC 261/WG 3 Test methods;
- ISO/TC 261/WG 4 Data and Design.

More recently, they were joined by Canadian Technical Committee SMC.

Of course, there are many others standards.

Through the activities of ISO have been developed Standards such as:

- ISO/ASTM 52915:2013. Standard specification for additive manufacturing file format (AMF);
- ISO/ASTM 52921:2013. Standard terminology for additive manufacturing – Coordinate systems and test methodologies;
- ISO 17296-4:2014. Additive manufacturing -- General principles -- Part 4: Overview of data processing;
- ISO 17296-3:2014. Additive manufacturing -- General principles -- Part 3: Main characteristics and corresponding test methods;
- ISO 28219:2009. Packaging -- Labelling and direct product marking with linear bar code and two-dimensional;
- ISO / CD 17296-1 "Additive manufacturing. General principles. Part 1: Terminology";
- ISO / DIS 17296-2 "Additive manufacturing -- General principles -- Part 2: Overview of process categories and feedstock";
- ISO / PRF 17296-3 "Additive Manufacturing. General principles. Part 3: Main characteristics and corresponding test methods";
- ISO / PRF 17296-4 "Additive manufacturing -- General principles -- Part 4: Overview of data processing";
- ISO / ASTM 52915: 2013 "Standard specification for the file format used in the production of the additive (Additive Manufacturing File Format; AMF) version 1.1";
- ISO / ASTM 52921: 2013 "Standard Terminology for additive manufacturing. Coordinate systems and test methodologies."

Additive Manufacturing File Format (AMF) is an open standard for describing objects for additive manufacturing processes such as 3D printing. The official ISO/ASTM 52915:2013 standard is an XML-based format designed to allow any computer-aided design software to describe the shape and composition of any 3D object to be fabricated on any 3D printer. Unlike its predecessor STL format, AMF has native support for color, materials, lattices, and constellations. An AMF can represent one object, or multiple objects arranged in a constellation. Each object is described as a set of non-overlapping volumes. Each volume is described by a triangular mesh that references a set of points (vertices). These vertices can be shared among volumes. An AMF file can also specify the material and the color of each volume, as well as the color of each triangle in the mesh. The AMF file is compressed using the zip compression format, but the ".amf" file extension is retained.

Then there is the problem in the standardization of materials for the 3d printers and devices. For different printers the materials and its parts are very different too. It’s the problem, because the details of one printer model is incompatible for others. In the case of damage it’s impossible to replace damaged parts. Again they are expensive.

Now the problems of standardization are solving. Many documents have already published, but big part of it is in progress.

1. SASAM home page, available at: [http://www.sasam.eu/]
2. ISO/ASTM 52915:2013, available at: [http://www.iso.org/iso/standards_development/technical_committees/other_bodies/iso_technical_committee.htm?commid=629086]
3. ISO-Standarts, available at: [http://www.iso.org/iso/home/standards.htm]
4. Excell, Jon. "The rise of additive manufacturing". The engineer. Retrieved 2013-10-30.
5. "3D printing: 3D printing scales up". The Economist. 2013-09-07.
6. ISO/ASTM, AMF-standard, available at: [http://www.astm.org/Standards/ISOASTM52915.htm]