



ASTM INTERNATIONAL
Helping our world work better

Standards Development for Additive Manufacturing – ASTM/ISO/CEN Collaboration

28 September 2016
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www.astm.org



What is ASTM?



- A proven and practical system
 - Established in 1898
 - 147 Committees & 12,500+ Standards
 - 33,000 members
 - 8,000+ International Members from 135 countries
 - 5,100 ASTM standards used in 75 countries
 - 'Audited Designator' accreditation: American National Standards Institute (ANSI)
 - Process complies with WTO principles: Annex 4 of WTO/TBT Agreement
 - All stakeholders involved (Public & Private Sector Cooperation)
 - Neutral forum
 - Consensus-based procedures
- Development and delivery of information made uncomplicated
- A common sense approach: industry driven
- Market relevant globally
- No project costs



ASTM in Europe



Footprint is Strong and Constantly Growing

- ASTM members in Europe
 - 1100+ representing 23 Countries
- ASTM Office in Brussels
 - [Sara Gobbi](#)
Director of EU Affairs, ASTM International
Rue de la Loi 67
B-1040 Brussels, Belgium
Phone: +32 (0) 28-405-127
- Quality Relationship with European Regulatory Agencies
 - EASA (ASTM standards are accepted and referenced by EASA aviation regulations)
 - ASTM Committee F37 on LSA
 - ASTM Committee F39 on Aircraft Systems
 - ASTM Committee F44 on GA
 - JRC
 - EMA

ASTM Committee F42 on Additive Manufacturing Technologies



- Organized January 2009 by Industry
- Current Roster: 409 Individuals & Organizations
 - 20 Countries (112 members) = +27% of roster
 - 13 Approved Standards
 - 15+ Work Items Under Development
- 6 Technical Subcommittees
 - [F42.01](#) Test Methods
 - [F42.04](#) Design
 - [F42.05](#) Materials and Processes
 - [F42.06](#) Environment, Health, and Safety
 - [F42.91](#) Terminology
 - [F42.95](#) US TAG to ISO TC 261



Committee Scope



“The promotion of knowledge, stimulation of research, and implementation of technology through the development of standards for additive manufacturing technologies. The work of this Committee will be coordinated with other ASTM technical committees and other national and international organizations having mutual or related interests.”

Stakeholder Representation



Countries

Belgium, Canada, China, France, Germany, India, Italy, Japan, Mexico, Netherlands, Norway, Pakistan, Singapore, Slovakia, South Africa, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States

Key Stakeholder Groups

Government

Air Force Research Lab (US), FAA (US), FBI (US), FDA (US), NASA (US), NAVAIR (US), NIST (US)

Academia

China Jiliang University (China), Cornell University (US), DeMontfort University (UK), Georgia Institute of Technology (US), Milwaukee School of Engineering (US), North Carolina University (US), Norwegian University of Science and Technology (Norway), Rochester Institute of Technology (US), Texas University at El Paso (US), University of Louisville (US), University of Maryland (US), University of Nottingham (UK), University of Texas (US), Universidad de Zaragoza (Spain), University of Ulster (UK),

Industry

Alcoa (US), Arcam (Sweden), Arkema (France), Autodesk (US), BAE Systems (UK), Boeing (US), China Nuclear Power Engineering Company (CNPEC - China), EOS (Germany), Evonik Degussa (Germany), GE (US), GKN Aerospace (US), Gulfstream Aerospace (US), Honeywell (US), Lockheed (US), Materialise (Belgium), Met-L-Flo, Inc. (US), Northrop Grumman (US), Objet Geometries (Israel), Pratt & Whitney (US), Rolls Royce (US), Schlumberger (US), Siemens (Germany), Stratasys (US)

Trade Associations

CECIMO (EU), National Center for Manufacturing Sciences (US), Rapid Product Development Association of South Africa (RSA), Society of Manufacturing Engineers (US)

F42 Work Program



Subcommittee F42.01 on Test Methods

- [F2971-13 Standard Practice for Reporting Data for Test Specimens Prepared by Additive Manufacturing](#)
- [F3122-14 Standard Guide for Evaluating Mechanical Properties of Metal Materials Made via Additive Manufacturing Processes](#)
- [ISO/ASTM52921-13 Standard Terminology for Additive Manufacturing-Coordinate Systems and Test Methodologies](#)

- [WK49798](#) New Guide for Intentionally Seeding Flaws in Additively Manufactured (AM) Parts
- [WK49229](#) New Guide for Orientation and Location Dependence Mechanical Properties for Metal Additive Manufacturing
- [WK55297](#) Additive Manufacturing -- General Principles -- Standard Test Artefacts for Additive Manufacturing
- [WK55610](#) Test Methods for the Characterization of Powder Flow Properties for Additive Manufacturing Applications

F42 Work Program



Subcommittee F42.04 on Design

- [ISO/ASTM52915-16 Standard Specification for Additive Manufacturing File Format \(AMF\) Version 1.2](#)
- [WK38342](#) Guide for Design for Additive Manufacturing
- [WK48549](#) Specification for AMF Support for Solid Modeling: Voxel Information, Constructive Solid Geometry Representations and Solid Texturing
- [WK54856](#) Principles of Design Rules in Additive Manufacturing

F42 Work Program



Subcommittee F42.05 on Materials and Processes

- [F2924-Standard Specification for Additive Manufacturing Titanium-6 Aluminum-4 Vanadium with Powder Bed Fusion](#)
- [F3001-Standard Specification for Additive Manufacturing Titanium-6 Aluminum-4 Vanadium ELI \(Extra Low Interstitial\) with Powder Bed Fusion](#)
- [F3049-Standard Guide for Characterizing Properties of Metal Powders Used for Additive Manufacturing Processes](#)
- [F3055-Standard Specification for Additive Manufacturing Nickel Alloy \(UNS N07718\) with Powder Bed Fusion](#)
- [F3056-Standard Specification for Additive Manufacturing Nickel Alloy \(UNS N06625\) with Powder Bed Fusion](#)
- [F3091/F3091M-Standard Specification for Powder Bed Fusion of Plastic Materials](#)
- [F3184-Standard Specification for Additive Manufacturing Stainless Steel Alloy \(UNS S31603\) with Powder Bed Fusion](#)
- [F3187-Standard Guide for Directed Energy Deposition of Metals](#)

- [WK51282](#) Additive Manufacturing, General Principles, Requirements for Purchased AM Parts (**ON BALLOT**)
- [WK51329](#) Additive Manufacturing Cobalt-28 Chromium-6 Molybdenum Alloy (UNS R30075) with Powder Bed Fusion¹
- [WK53423](#) Additive Manufacturing AISi10Mg with Powder Bed Fusion
- [WK53425](#) Thermal Post Processing of Metal Powder Bed Fusion Parts
- [WK53878](#) Additive Manufacturing - Material Extrusion Based Additive Manufacturing of Plastic Materials - Part 1: Feedstock materials
- [WK53879](#) Additive Manufacturing - Material Extrusion Based Additive Manufacturing of Plastic Materials - Part 2: Process-equipment
- [WK53880](#) Additive Manufacturing - Material Extrusion Based Additive Manufacturing of Plastic Materials: Final Part Specification

F42 Work Program



F42.91 on Terminology

- [ISO/ASTM52900-15 Standard Terminology for Additive Manufacturing – General Principles – Terminology](#)
- [F2792-12a Standard Terminology for Additive Manufacturing Technologies \(Withdrawn 2015\)](#)



Why?

- Whereas one of the objectives of ISO is to facilitate the international exchange of goods and services through the development of International Standards,
- Whereas the ISO Council has adopted a policy of inclusiveness and encourages cooperation between ISO and other standardizing bodies, where such cooperation would serve to ensure effective and efficient use of resources available for standardization activities,
- Considering that ASTM INTERNATIONAL develops standards that achieve global recognition and use,
- Considering consultations with the ISO member body in the country where ASTM INTERNATIONAL has its legal seat (ANSI),
- ISO and ASTM INTERNATIONAL agree to the following principles of cooperation in the field(s) covered by ISO/TC 261 on Additive Manufacturing and ASTM INTERNATIONAL Committee F42 on Additive Manufacturing:

Implementation (How):

- Signed 24 September, 2011 by ISO Secretary General & ASTM International President
- ASTM, ISO, DIN, & WG Conveners developed protocol to govern proposal process
- F2915 Standard Specification for Additive Manufacturing File Format (AMF) & F2921 Standard Terminology for Additive Manufacturing - Coordinate Systems and Test Methodologies, F2792 Standard Terminology for Additive Manufacturing Technologies approved as ISO/ASTM standards.
- ASTM holds US TAG to ISO TC261
- ASTM presence at TC261 meetings

Sections on:

- Normative Referencing
- FDIS Fast Track Processing of Existing (ASTM) Standards (3 to date)
- Adoption of ISO Standard by ASTM
- Cooperation in Developing Joint ISO/ASTM Standard (15 in process to date)
- Maintenance

CEN Relationship



CEN TC438 on Additive Manufacturing (2015)

- Scope: “Standardization in the field of Additive Manufacturing (AM)”
- Secretary: Mr. Olivier Coissac (member of F42)
- Chairperson: Mr. Eric Baustert (member of F42)
- CEN Technical Secretariat(s): AFNOR
- CCMC Programme Manager: Ms. Monica Ibido

OBJECTIVES OF THE CEN/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

- The main objective of CEN/TC 438 is:
 - To provide a complete set of European standards on processes, test procedures, quality parameters, supply agreements, fundamentals and vocabulary based, as far as possible on international standardization work. **The aim is to apply the Vienna Agreement with ISO/TC 261 "Additive Manufacturing" (DIN) to ensure consistency and harmonization**
 - To strengthen the link between European Research programs and standardization in additive manufacturing
 - To ensure visibility to the European standardization in additive manufacturing by centralizing standardization initiatives in Europe on additive manufacturing

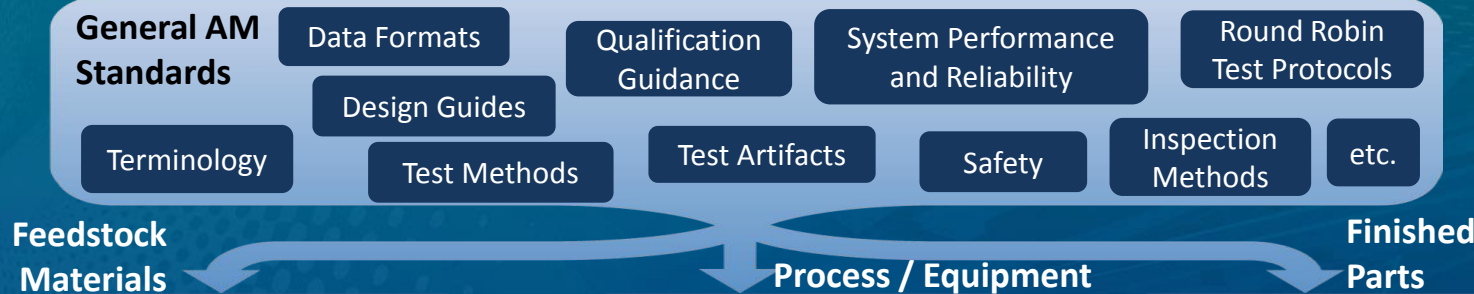
Identified strategies to achieve the CEN/TC's defined objectives

- The set of European standards shall comply with the common ISO/ASTM roadmap to follow.
- A main part of the strategy is to ensure a close cooperation between CEN/TC 438, ISO/TC 261 and ASTM F42 resulting in of set of standards in order to develop the common roadmap and organization structure for AM standards into the following four levels according to the figure to follow:
 - General standards: standards that specify general concepts, common requirements, or are generally applicable to most types of AM materials, processes, and applications,
 - Category standards: standards that specify requirements that are specific to a material category or process category,
 - Specialized standards: standards that specify requirements that are specific to a material, process, or application.
- Therefore, any new idea for a European standard shall first be proposed at ISO/ASTM level to follow the common ISO/ASTM structure of AM standards to follow.

AM Standards Structure

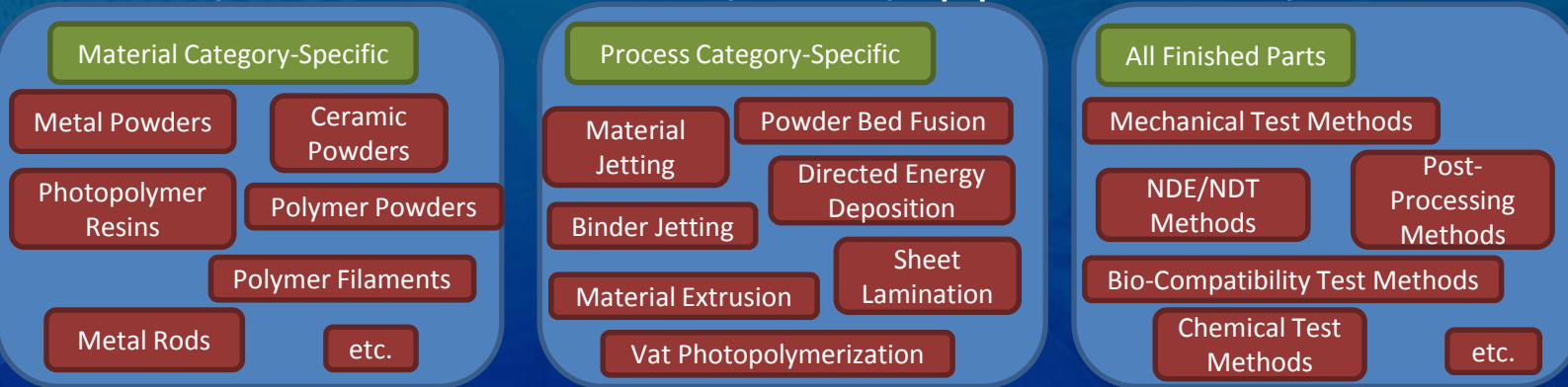
General Top-Level AM Standards

- General concepts
- Common requirements
- Generally applicable



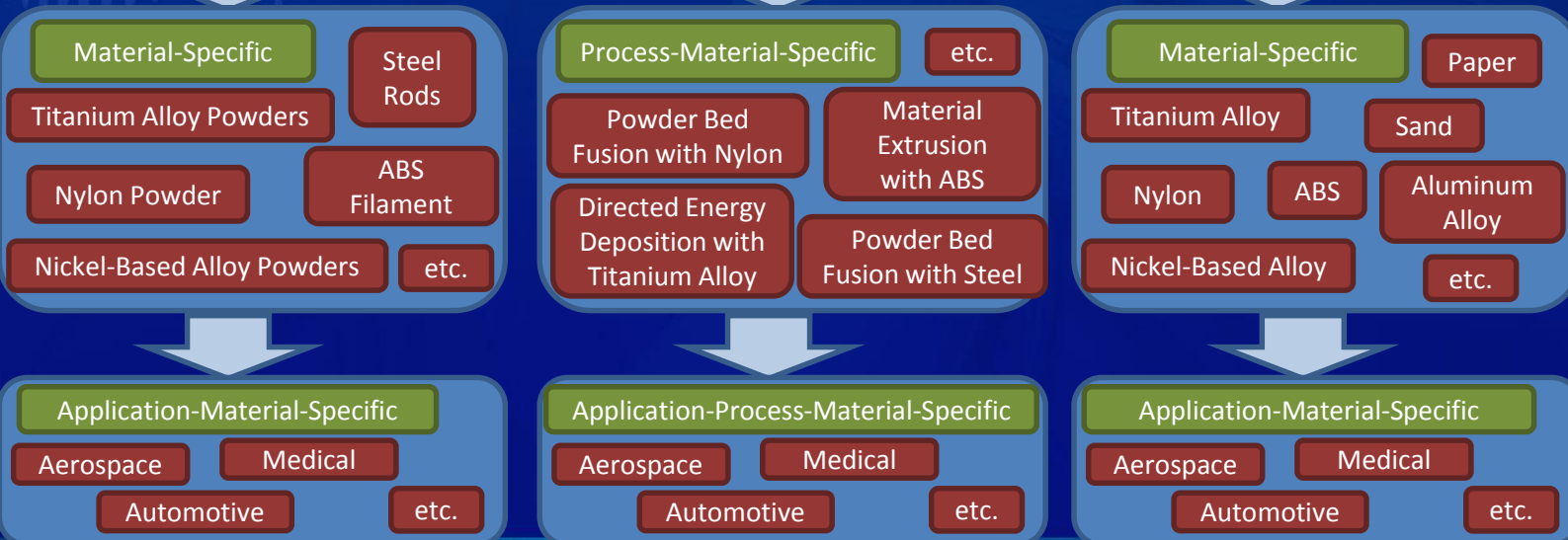
Category AM Standards

- Specific to material category or process category



Specialized AM Standards

- Specific to material, process, or application



TC438 Work Program



- 4 Standards Approved, including:
 - [FprEN ISO/ASTM 52921](#) (WI=00438001) Standard terminology for additive manufacturing - Coordinate systems and test methodologies (ISO/ASTM 52921:2013)
- 2 Standards Under Enquiry, including:
 - [prEN ISO 52900](#) (WI=00438005) Additive manufacturing - General principles - Terminology (ISO/ASTM 52900:2015)
 - [prEN ISO 52915](#) (WI=00438006) Specification for Additive Manufacturing File Format (AMF) Version 1.2 (ISO/ASTM 52915:2016)
- 2 Standards Under Drafting



Committee F42 <http://www.astm.org/COMMIT/COMMITTEE/F42.htm>

- Committee Video - <https://www.youtube.com/watch?v=cpqDfC2UqOc>
- “Manufacturing Goes Digital”
- Links to Future Meetings (30 January – 2 February, 2017 at University of Alabama School of Engineering & summer 2017 TBD, will take place in Europe)
- Subcommittee Listing with all Registered Work Items
- Main Committee Officers



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Thank you

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