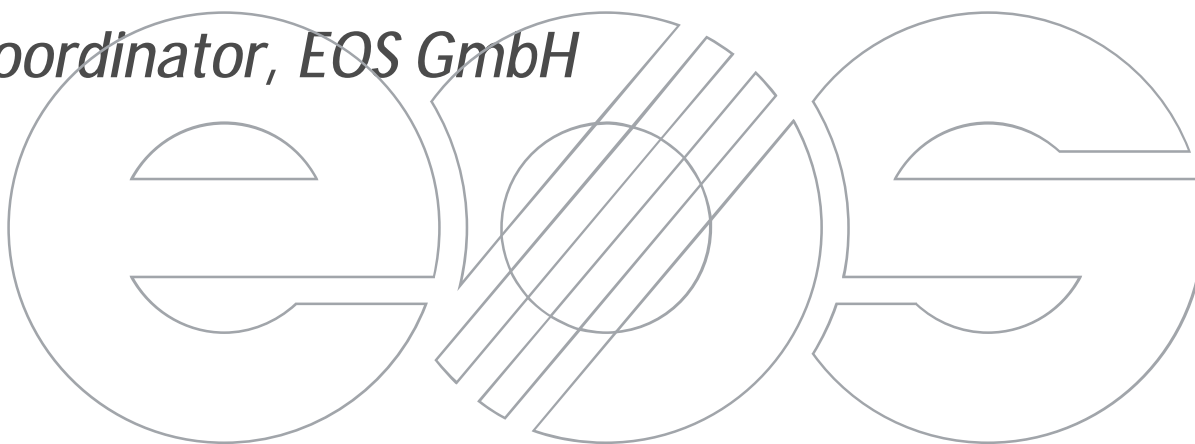


Standardization of industrial additive manufacturing

Jörg Lenz

Collaborative Projects Coordinator, EOS GmbH

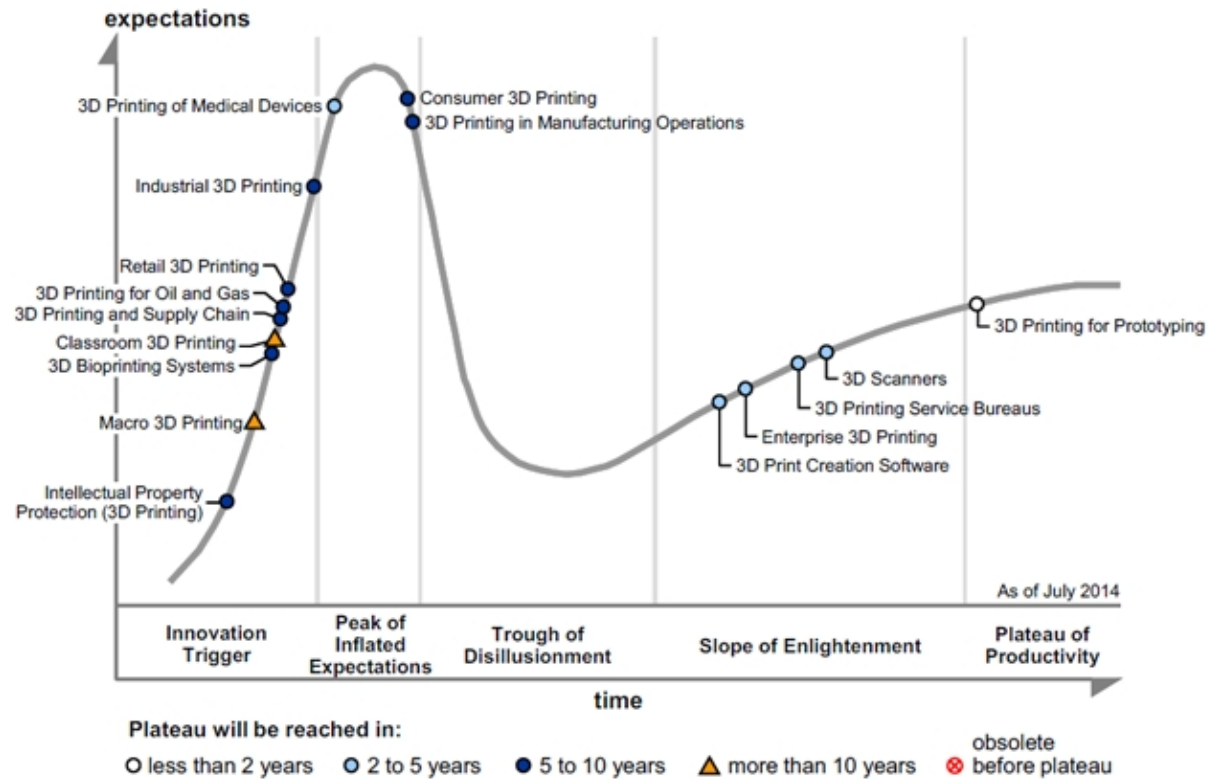


*International Conference On Additive Manufacturing
October 06, 2015*

Standards & Guides for AM

Why are they needed now?

~~§ 3D printing Hype?~~



Standards & Guides for AM



Why are they needed now?

~~\$ New Technology with innovation needs?~~

Standards & Guides for AM

Why are they needed now?

- § Missing knowledge about the technology?
 - § Standards/guides provide overview and recommendations
 - § They define conditions and characteristics
- § Uncertainty with regard to capability and opportunities?
 - § Standards/guides provide reliability and acceptance, dispel concerns, create safety
 - § Focus market stakeholder efforts
 - § further push the technology in the market by enabling commercialization

Standards development for AM

How to approach the topic?

§ Note:

§ "... a standard is a set of rules decided upon by consensus of all persons involved in a procedure and based on a regulated standardization process."

§ "... It represents the current state of science and technology."

§ development of new AM standards plus adaptation of conventional standards (if partly applicable), but

§ not end up in re-inventing the wheel!

§ Involve the right people

§ Do not lay out too wide or too academic

§ Avoid parallel activities; risk of „losing“ experts

§ Common approach with all world-wide standardization bodies and industry associations

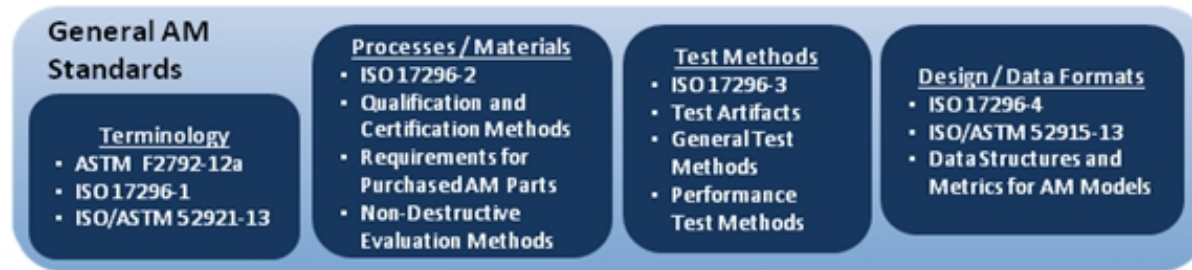
§ In a global economy there is no reason why standards/guides should define the same context differently in Europe, Asia and the US

§ The goal: one world – one standard

Structuring the AM standard development

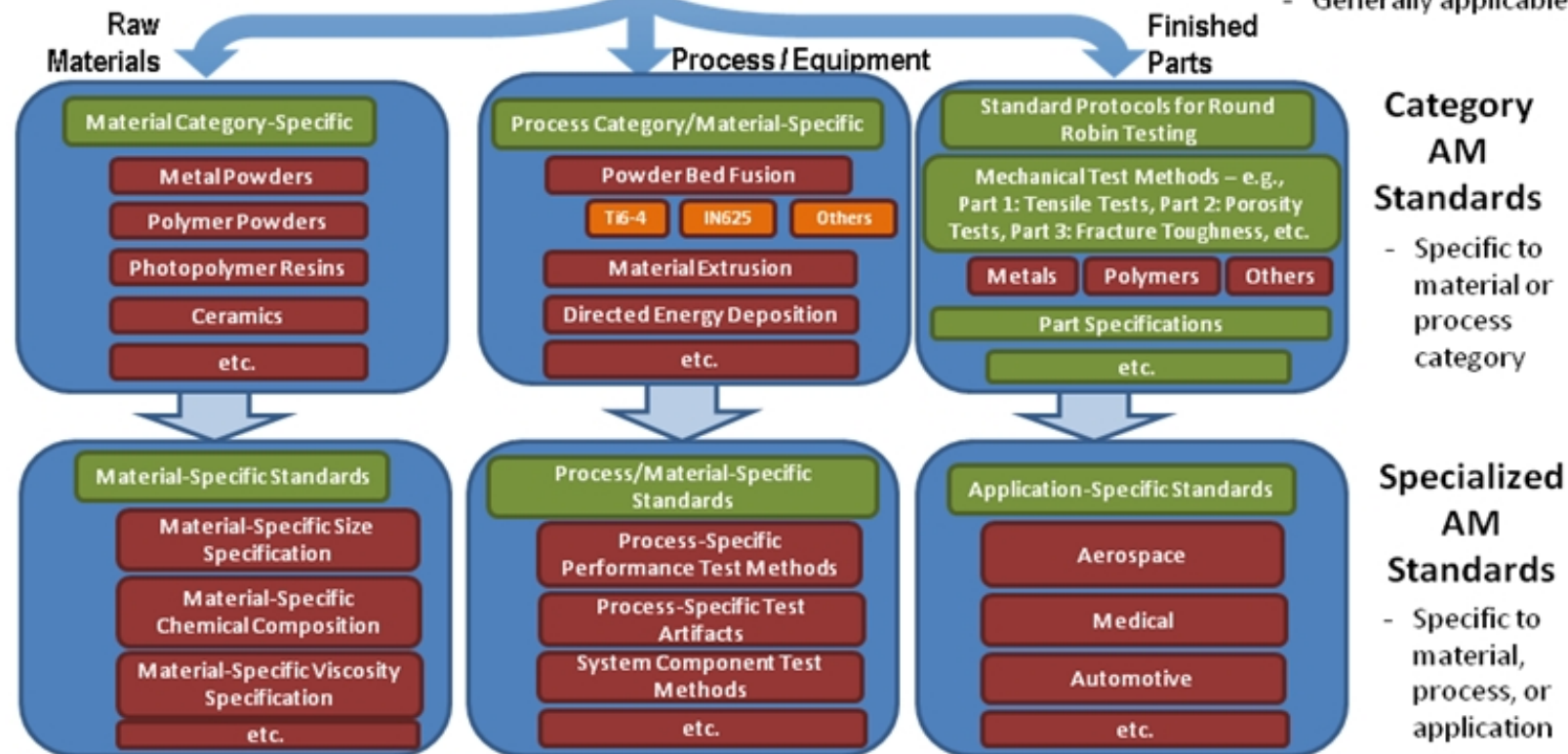


e-Manufacturing Solutions



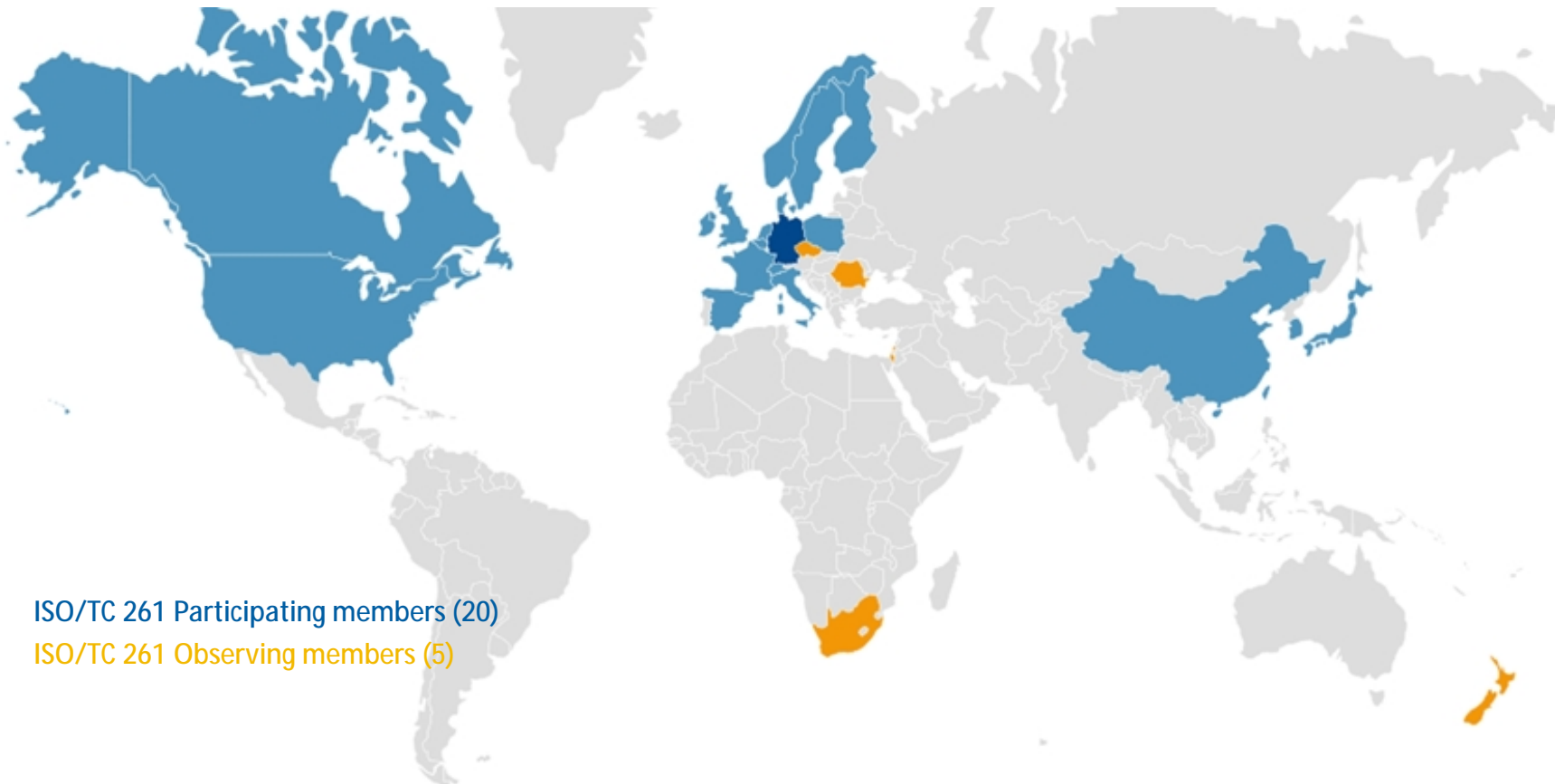
General Top-Level AM Standards

- General concepts
- Common requirements
- Generally applicable



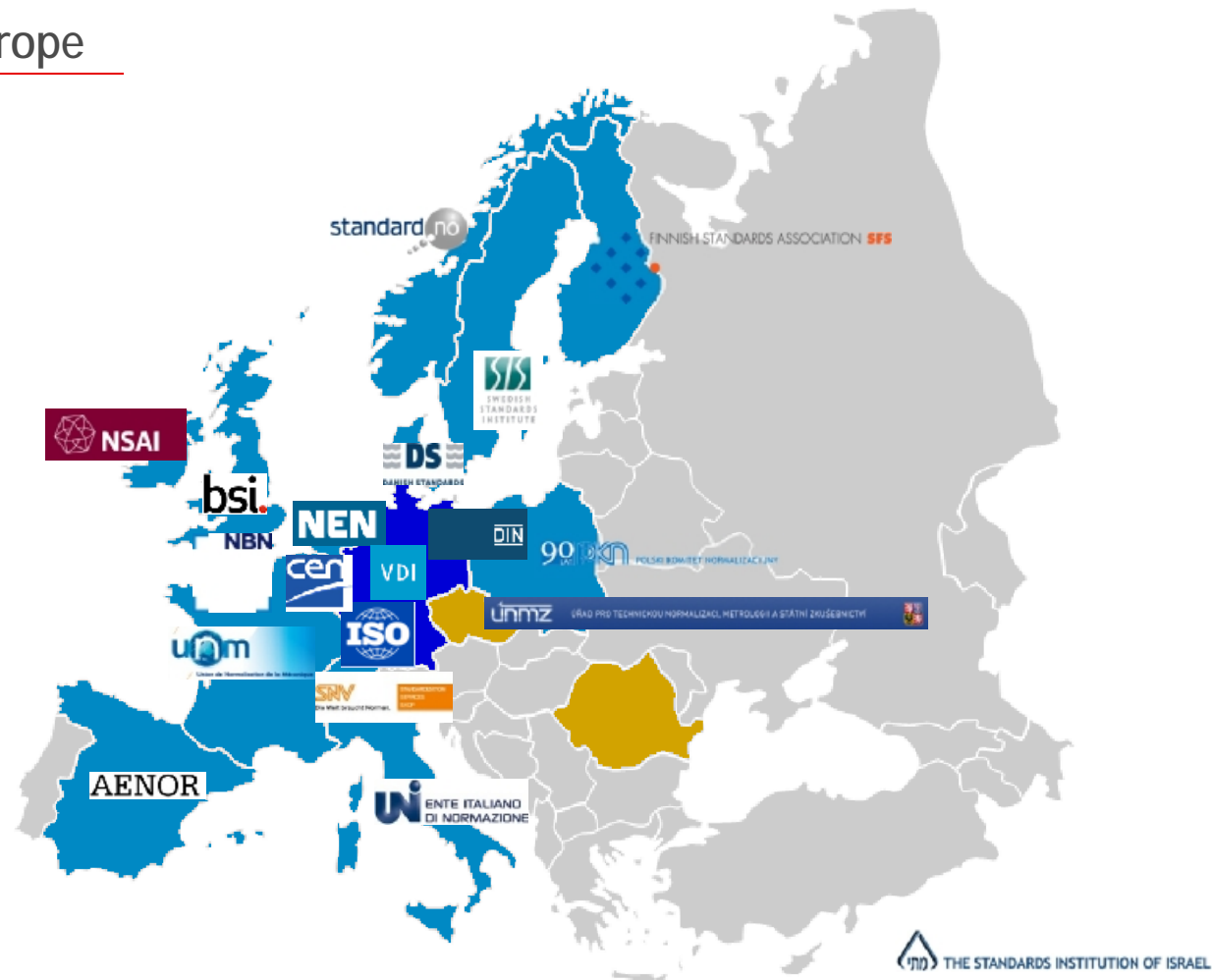
Worldwide AM standardization activities

Overview of the international activities known so far



Worldwide AM standardization activities

Strong focus in Europe



World-wide first Initiative – how everything started

§ Facts

§ Foundation January 2003, Chairman: Prof. Gerd Witt, University of Duisburg-Essen

§ membership: personal ~ 110 persons

§ Structure

- FA 105.1 Additive Manufacturing – Kunststoffe (plastics)
- FA 105.2 Additive Manufacturing – Metalle (metal)
- FA 105.3 Additive Manufacturing – Konstruktionsempfehlungen (design rules)



German VDI Fachausschuss GPL FB1_FA105

Published documents/projects - to become input for DIN and ISO/ASTM



number	title
VDI 3405 (12/2014)	Additive Manufacturing Processes Fundamentals, Terms, Process descriptions
VDI 3405 Part 1 (10/2013)	Additive Manufacturing Processes, Rapid Manufacturing Laser sintering of polymer parts, Quality control
VDI 3405 Part 1.1 (project started)	Additive Manufacturing Processes, Rapid Manufacturing Laser sintering of polymer parts – Material Qualification, Part Quality
VDI 3405 Part 2 (08/2013)	Additive Manufacturing Processes, Rapid Manufacturing Beam melting of metallic parts - Qualification, QA and post processing
VDI 3405 Part 2.1 (07/2014)	Additive Manufacturing Processes, Rapid Manufacturing Beam melting of metallic parts – Material Data Sheet AISi10Mg
VDI 3405 Part 2.2 (publishing soon)	Additive Manufacturing Processes, Rapid Manufacturing Beam melting of metallic parts – Material Data Sheet Nickel Super Alloys
VDI 3405 Part 2.3 (project started)	Additive Manufacturing Processes, Rapid Manufacturing Beam melting of metallic parts – Powder Materials
VDI 3405 Part 2.4 (project started)	Additive Manufacturing Processes, Rapid Manufacturing Beam melting of metallic parts – Material Data Sheet Ti6Al4V
VDI 3405 Part 3 (02/2015)	Additive Manufacturing Processes Design recommendations for building parts with LS and LBM

The German mirror committee to ISO/TC 261



§ Facts

§ Foundation September 2010, Chairman: Martin Schäfer (Siemens CT, Berlin)

§ membership: personal ~ 30 persons from EOS, Siemens, BMW, MTU, Evonik, Daimler, Concept, SLM, Voxeljet, Arburg, BAM, TÜV, Marcam, DMRC...

§ Main tasks

- Define the German position/comments in ISO/TC 261 and the German vote (with DIN as ISO member body)
- Prepare VDI guidelines (and other documents) to become new work items in ISO/TC 261
- Nominate the German delegates and experts for ISO/TC 261

ISO technical committee 261 on AM



Facts



§ Foundation 2011, Chairman: Jörg Lenz (EOS GmbH), secretary: DIN – Lutz Wrede

§ membership: national bodies (Countries)

§ P (actively participating): 20 (DE, ES, FR, **US**, GB, DK, BE, NL, IE, PL, SE, NO, CH, IT, **JP**, FI, **CAN**, **KR**, **CN**, **SG**)

§ O (just observing): 5 (**ZA**, **IL**, **NZ**, CZ, RO)

Red: non European countries

§ Liaisons with other committees, e.g.

§ ISO/TC 44 “Welding”

§ ISO/TC 61 “Plastics”

§ ISO/TC 106 “Dentistry”

§ ISO/TC 119 “Powder metallurgy”

§ ISO/TC 184 “Automation systems and integration”

§ ISO/TC 213 “Dimensional and geometrical product specifications and verification”

§ IEC/TC 76 “Optical radiation safety and laser equipment”

§ PSDO agreement with ASTM F42

ISO technical committee 261 on AM



Structure and work items

<p>ISO/TC 261 – WG 1 “Terminology” K. Boivie (Sweden) ISO 17296-1</p>	<p>ISO/TC 261 – WG 2 “Methods, processes and materials” F. Pfefferkorn (Germany) ISO 17296-2:2015</p>	<p>ISO/TC 261 – WG 3 “Test methods” P. Bertrand (France) ISO 17296-3:2014</p>	<p>ISO/TC 261 – WG 4 “Data and design” E. Pei (UK) ISO 17296-4:2014 ISO/ASTM 52915:2013 ISO/ASTM FDIS 52915 ISO/ASTM 52921:2013</p>
<p>JG 51 - Terminology K. Boivie (ISO) ISO/ASTM 52900</p>	<p>JG 55 – Extrusion based AM of plastic materials R. Buoniconti (ASTM) ISO/ASTM CD 20196-1</p>	<p>JG 52 – Standard test artifacts S. Moylan (ASTM) ISO/ASTM 20191</p>	<p>JG 54 – Design guidelines D. Rosen (ASTM) ISO/ASTM DIS 20195</p>
	<p>JG 56 – Metal PBF to meet rigid quality requirements S. Collins (ASTM) ISO/ASTM 20197</p>	<p>JG 53 – Requirements for purchased AM parts P. Bertrand (ISO) ISO/ASTM DIS 52901</p>	<p>JG 57 – Specific design guidelines on PBF C. Seidel (ISO)</p>
	<p>JG 58 – Qualification, QA, post processing of PBF metallic parts M. Lakomic (ISO)</p>	<p>JG 59 – NDT for AM parts B. Dutton (ISO)</p>	<p>ISO/TC 261 – Adhoc group STEP, STEP NC, AMF A. Bernard (France)</p>

CEN technical committee 438 on AM



Facts



- § Foundation 2015, Chairman: Eric Baustert (F), secretary: AFNOR – Olivier Coissac
- § membership: national bodies (EU countries)
- § 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
- § Decision was made to adapt ISO 17296-2:2015, ISO 17296-3:2014, ISO 17296-4:2014 and ISO/ASTM 52921:2013

Other activities

Europe awakens and follows the hype – Asia shows interest in ISO/TC 261



- § SASAM – Support Action for Standardization in Additive Manufacturing
 - § FP7 Project, 01.09.2012 – 28.02.2014
 - § Mission: integration and coordination of standardization activities for Europe by creating and supporting a standardization organization in the field of AM
 - § Additional objective: create a roadmap for standardization of AM technology
- § CEN STAIR-AM platform on Additive Manufacturing



- § AFNOR: committee UNM 920 Fabrication additive



- § NEN: committee NC 341107 on Additive Manufacturing



- § AENOR: committee AEN/CTN 116 including AM



- § SIS: committee SIS/TK 563 on Additive Manufacturing



- § BSI: committee AMT/8 on Additive Manufacturing

- § and many others...

- § Various national and international associations/SDO starting with AM activities

- § Japan, Singapore, Korea and China have established mirror committees to ISO/TC 261

Thank you for your attention!

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