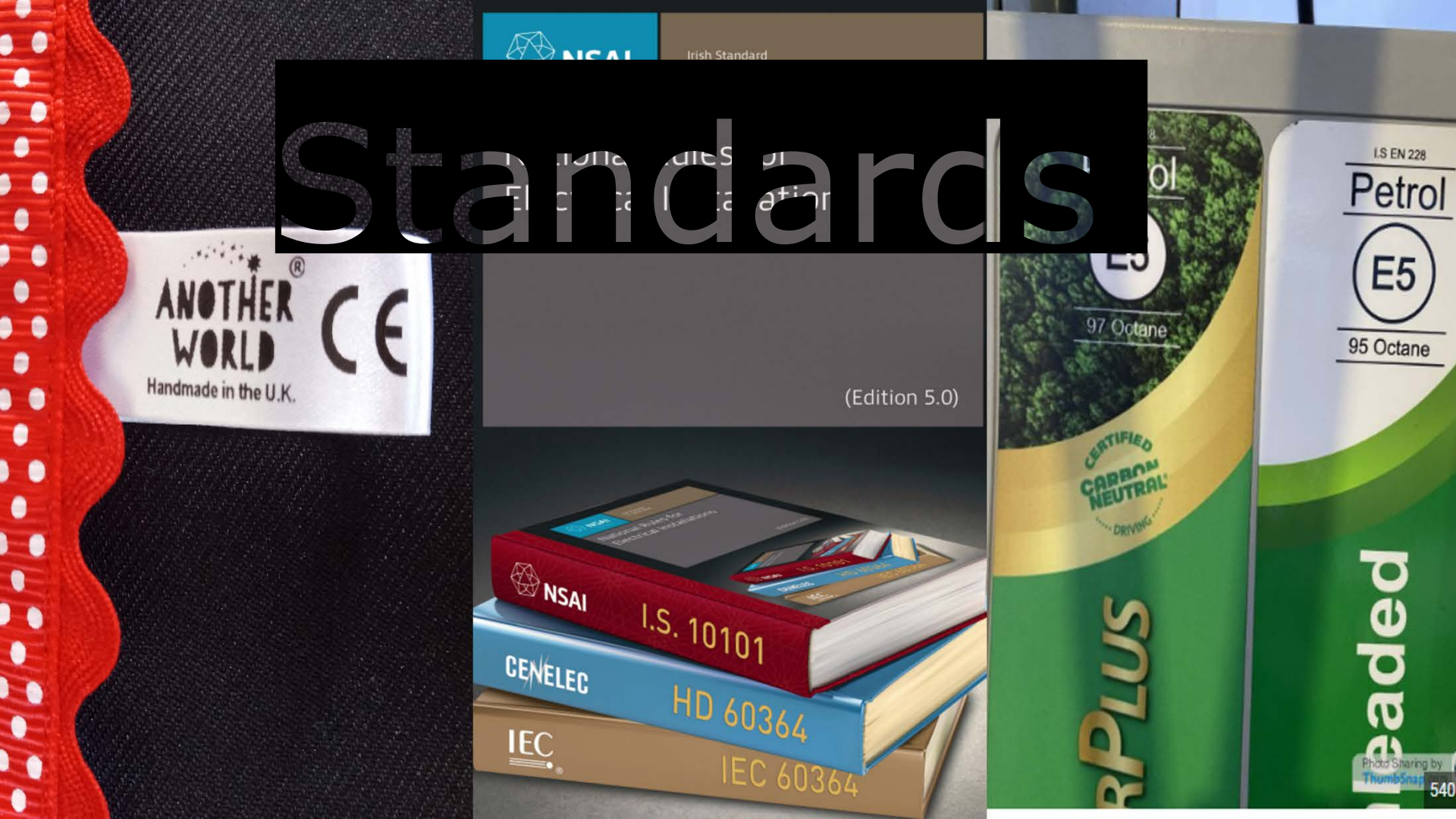

NSAI
NSAI
National Standards Authority of Ireland
Providing confidence in your business or product
NSAI.ie
NSAI
SUSTAINABLE DEVELOPMENT GOALS
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Standards


ANOTHER WORLD
Handmade in the U.K.
CE
Irish Standard
(Edition 5.0)
NSAI
I.S. 10101
CENELEC
HD 60364
IEC
IEC 60364
I.S EN 228
Petrol
E5
95 Octane
97 Octane
CERTIFIED
CARBON NEUTRAL
DRIVING
Photo Sharing by
ThumbSnap

Additive Manufacturing Standards

Guiding principles in AM Standardization

- One set of AM standards – to be used globally "One world – One Standard"
- Work on a common roadmap and organizational structure for AM standard
- Use and elaborate upon existing standards, modified for AM purposes when necessary to increase efficiency and effectiveness
- ISO/TC 261, ASTM F42 and CEN/TC 438 work together and in the same direction with an emphasis on joint standards development

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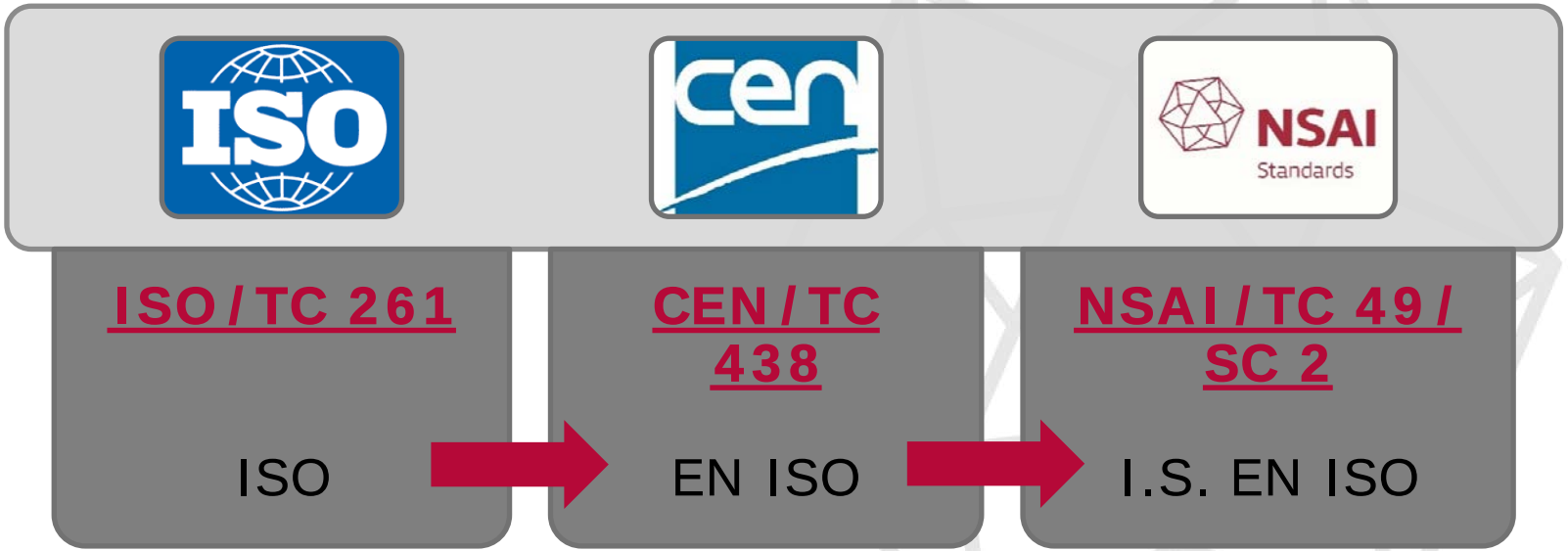
Global Standards used locally worldwide

National AM Standards



ISO standards are not normally adopted as Irish Standards
Only ISO standards adopted as European Standards are adopted as Irish Standards

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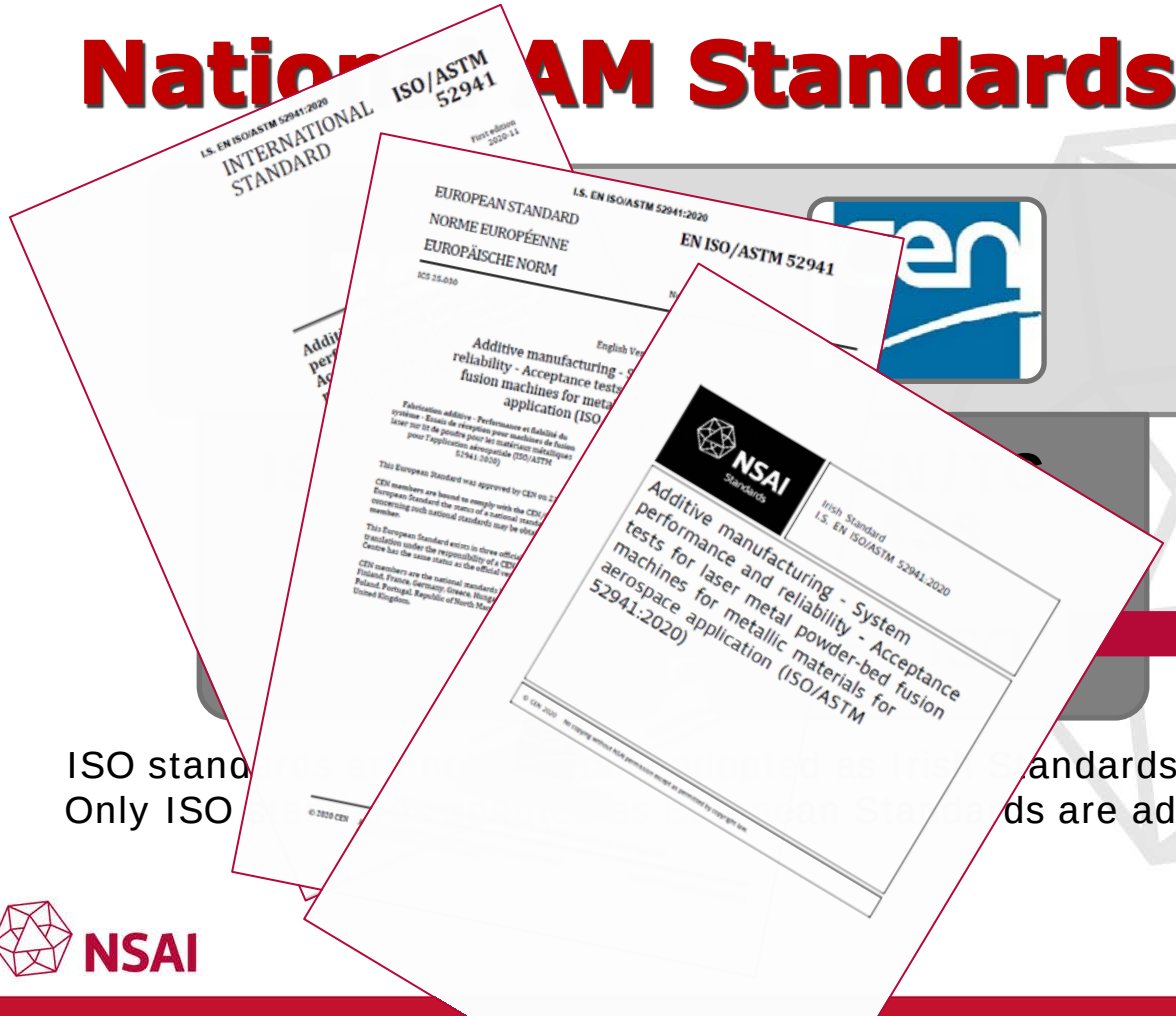
ISO

Nation AM Standards



ISO stand andards
Only ISO ds are adopted as Irish Standards

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ISO

ISO/TC 261 – Additive Manufacturing

Secretariat – DIN (Germany)
27 P-members (including IRELAND)

42 Published Standards
24 Standards under development

WG 1	Terminology
WG 2	Methods, processes and materials
WG 3	Test methods
WG 4	Data & design
WG 6	Environment, health & safety
JWG 10	Aerospace

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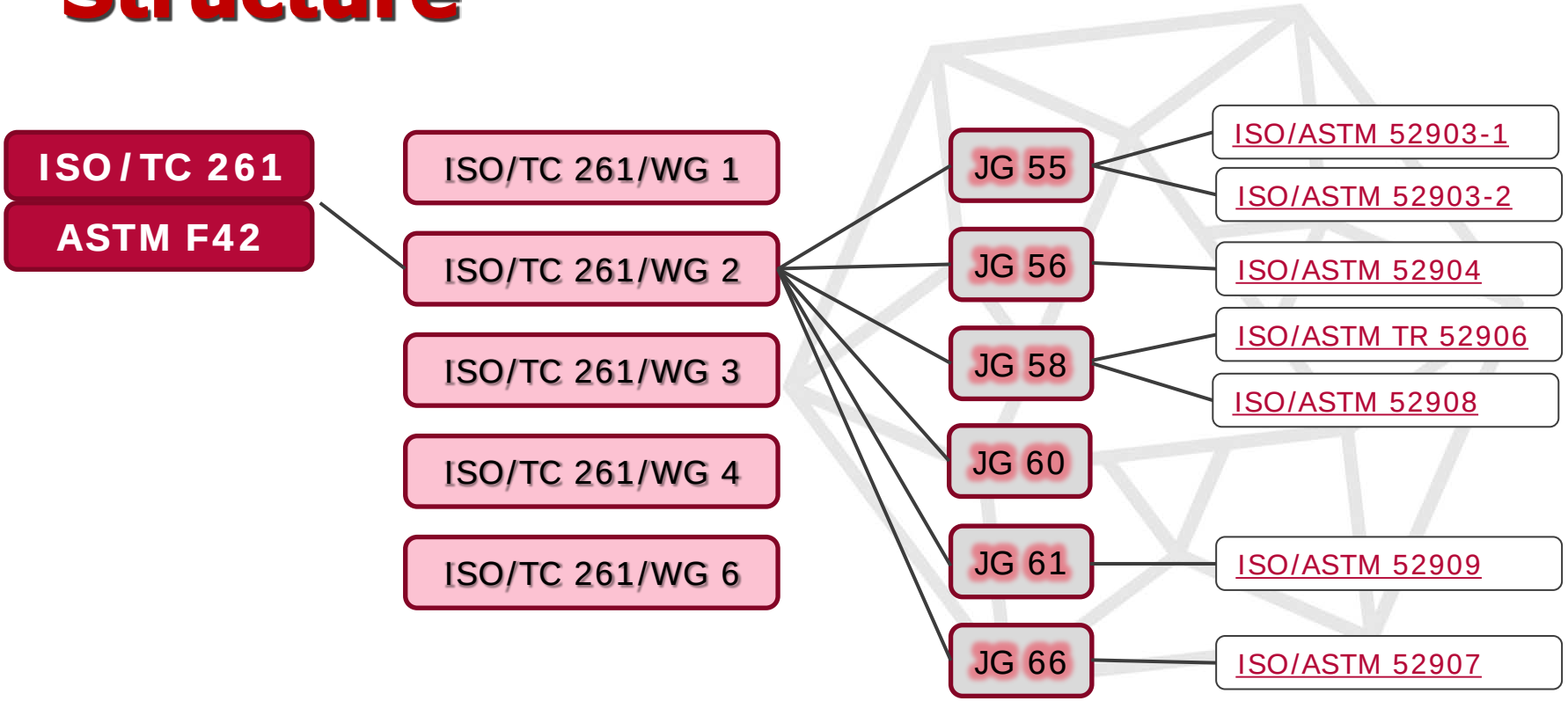
ISO

Structure



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ISO

Terminology

ISO/ASTM 52900:2021
General principles — Fundamentals and vocabulary

Materials

Personnel

Process

Metal melting?

No! Directed Energy Deposition, actually

g, QA

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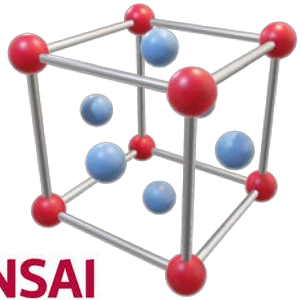
ISO

Standards in Additive Manufacturing

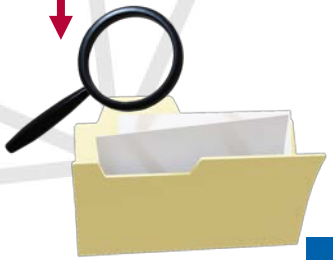
Data & Design

Process

Materials



Personnel



Testing, QA

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ISO

Data & Design

ISO/ASTM 52912:2022
Additive manufacturing — Design — Functionally graded additive manufacturing

ISO/ASTM 52910:2018
Design — Requirements, guidelines and recommendations

ISO/ASTM TR 52912:2020
Design — Functionally graded additive manufacturing

ISO/ASTM 52911-1:2019
Design — Part 1: Laser-based powder bed fusion of metals

ISO/ASTM 52911-2:2019
Design — Part 2: Laser-based powder bed fusion of polymers

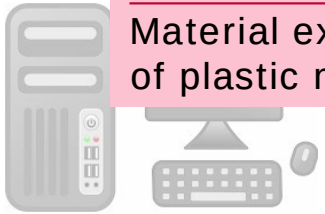
ISO/ASTM 52915:2020
Specification for additive manufacturing file format (AMF) Version 1.2

ISO/ASTM 52916:2022
Additive manufacturing for medical — Data — Optimized medical image data

ISO/ASTM 52950:2021
General principles — Overview of data processing

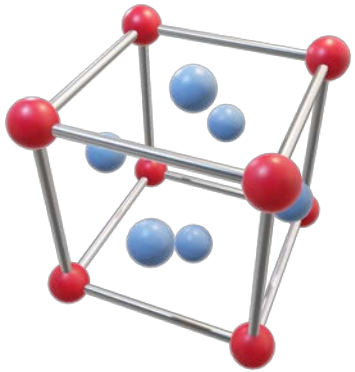
ISO/ASTM 52911-3:2023
Additive manufacturing — Design — Part 3: PBF-EB of metallic materials

Materials



ISO/ASTM 52903-1:2020
Material extrusion-based additive manufacturing of plastic materials — Part 1: Feedstock materials

ISO/ASTM 52903-2:2020
Material extrusion-based additive manufacturing of plastic materials — Part 2: Process equipment



ISO/ASTM 52907:2019
Feedstock materials — Methods to characterize metal powders

ISO ASTM 52925:2022
Additive manufacturing of polymers — Feedstock materials — Qualification of materials for laser-based powder bed fusion of parts

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ISO

Personnel

ISO/ASTM 52935:2023
Additive manufacturing of metals — Qualification principles — Qualification of coordination personnel

ISO/ASTM 52926-1:2023
Qualification principles — Part 1: General qualification of operators

ISO/ASTM 52930:2021
Additive manufacturing — Qualification principles — Installation, operation and performance (IQ/OQ/PQ) of PBF-LB equipment

ISO/ASTM 52945:2023
Additive manufacturing for automotive — Qualification principles — Generic machine evaluation and specification of key performance indicators for PBF-LB/M processes

Process

ISO 17296-2:2015
Additive manufacturing — General principles — Part 2: Overview of process categories and feedstock

ISO/ASTM 52903-2:2020
Material extrusion-based additive manufacturing of plastic materials — Part 2: Process equipment

ISO/ASTM 52904:2019
Process characteristics and performance — Practice for metal powder bed fusion process to meet critical applications

ISO/ASTM 52908:2023
System performance and reliability — Acceptance tests for laser metal powder-bed fusion machines for metallic materials for **aerospace** application

ISO/ASTM 52920:2023
Additive manufacturing — Qualification principles — Requirements for industrial additive manufacturing processes and production sites

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ISO

Testing & Inspection

Data & Design

Process

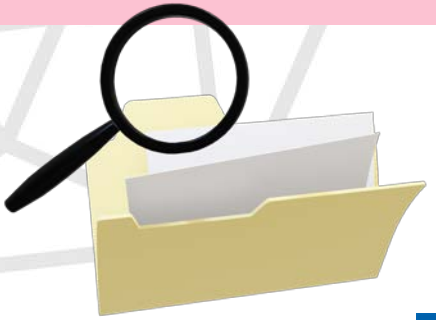
ISO/ASTM TR 52905:2023
Additive manufacturing of metals — Non-destructive testing and evaluation — Defect detection in parts

ISO/ASTM 52902:2019
Test artifacts — Geometric capability assessment of additive manufacturing systems

ISO/ASTM TR 52906:2022
Additive manufacturing — Non-destructive testing — Intentionally seeding flaws in metallic parts

ISO/ASTM 52901:2017
General principles — Requirements for purchased AM parts

ISO/ASTM TR 52917:2022
Additive manufacturing — Round robin testing — General guidelines



ISO/ASTM 52908:2023
Additive manufacturing of metals — Finished part properties — Post-processing, inspection and testing of parts produced by powder bed fusion

Testing, QA

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ISO

In development

Environment, health, and safety — Test method for determination of particle and chemical emission rates from desktop material extrusion 3D printer

Metal powder bed fusion process to meet critical applications

Design — Requirements, guidelines and recommendations

Data formats — File format support, ecosystem and evolutions

Test methods for metal casting sand moulds

Powder life cycle management

Directed energy deposition of metals

Presentation of material properties in material data sheets

Tasks and related skills for AM

Data packages for AM part

Safety requirements for PBF-LB machines

Compression validation coupons for lattice designs

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ISO

Manufacturing Standards supporting Business

3D scanning of patient limb
– point cloud data

IRISH MANUFACTURING RESEARCH

Prescription and rectification
– CAD data

APOS
Atlantic Prosthetic Orthotic Service

Additive Manufacture
– physical part

ISO /ASTM 52950:2021 – Overview of data processing. This Standard supported identification of best practice for data handling	ISO/ASTM 52902:2019 – Geometric accuracy of a Manufacturing Process. This Standard supported qualification of machines used to build test coupons and product, and provided useful tools for ongoing process control	ISO/ASTM 52901:2017 – General requirements of AM parts. This standard supported risk control activities during design development and process validation	ISO/ASTM 52921:2013 - Standard terminology for additive manufacturing — Coordinate systems and test methodologies. This standard supported communication and documentation of best practice clearly and unambiguously

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Standards were identified and leveraged to determine, measurables Critical to Quality design, that enabled this innovation

Re s

Sectoral Study of Standards in Manufacturing

LINK

Introduction to NSAI/TC 49/SC 2 & standardizatio n for Additive Manufacturing

LINK

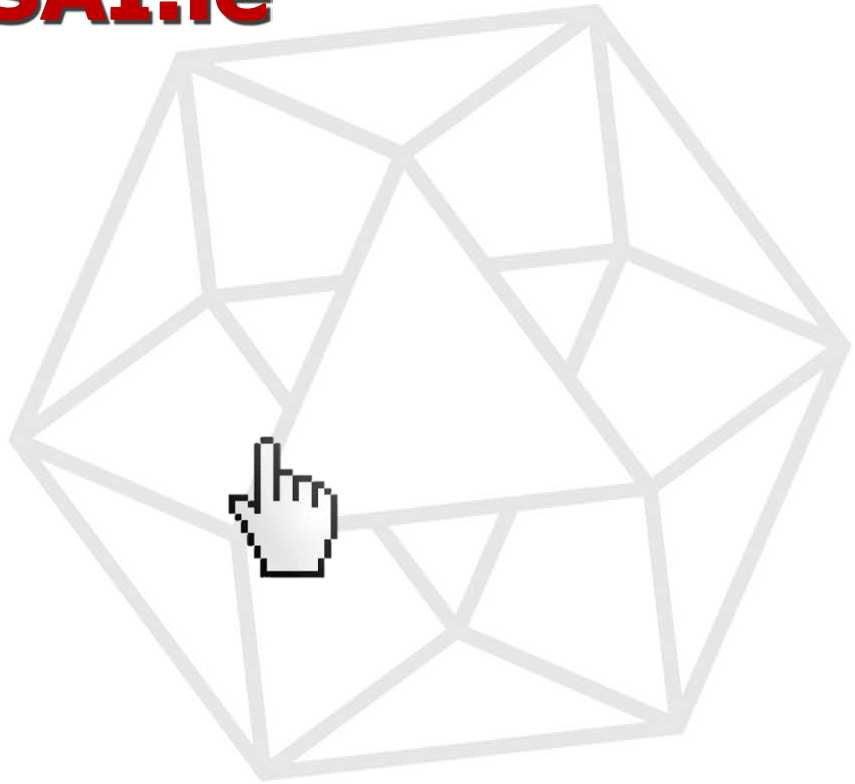
NSAI

Advanced Manufacturing Technologies

Scan to visit!

NSAI

Get involved – NSAI.ie



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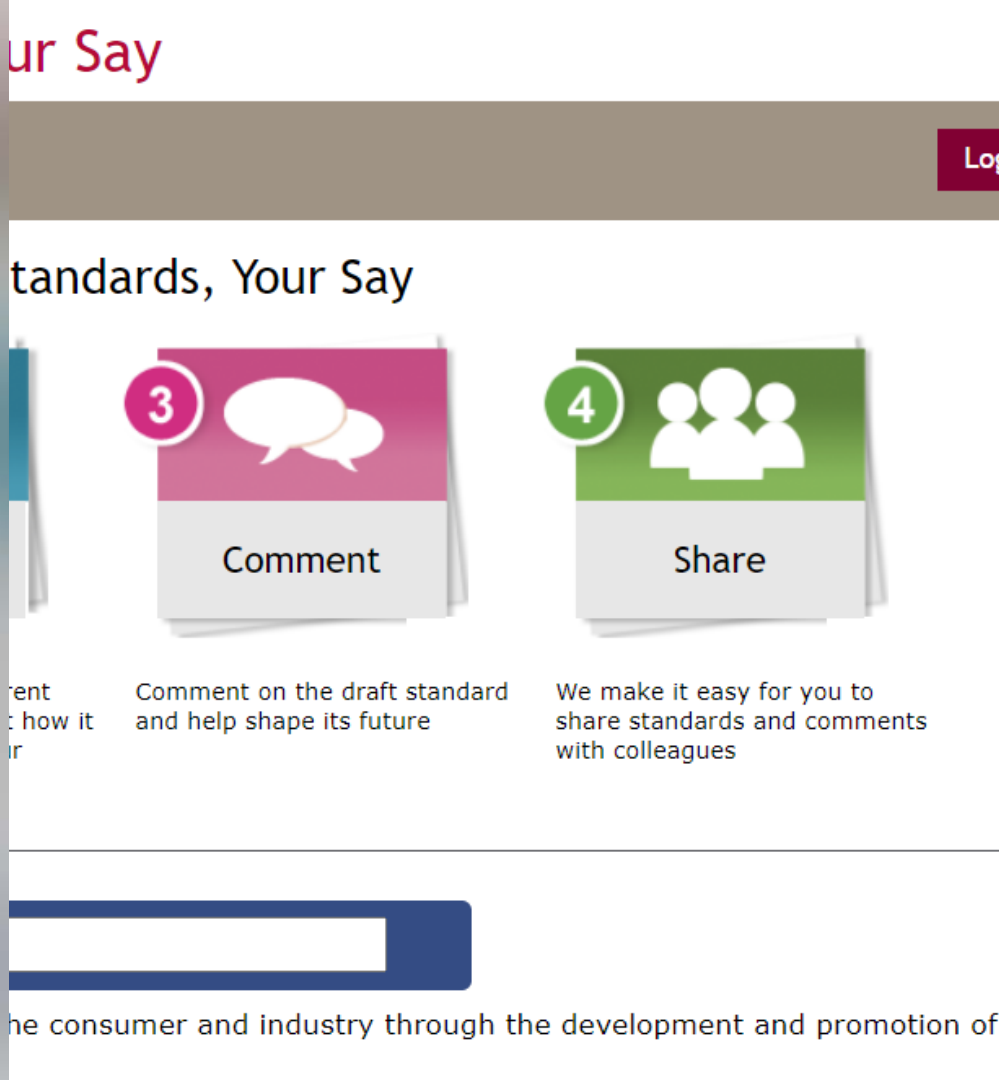
Input to draft Standards

Your Standards, Your Say

Review, Read & Comment on drafts

www.nsainep.ie



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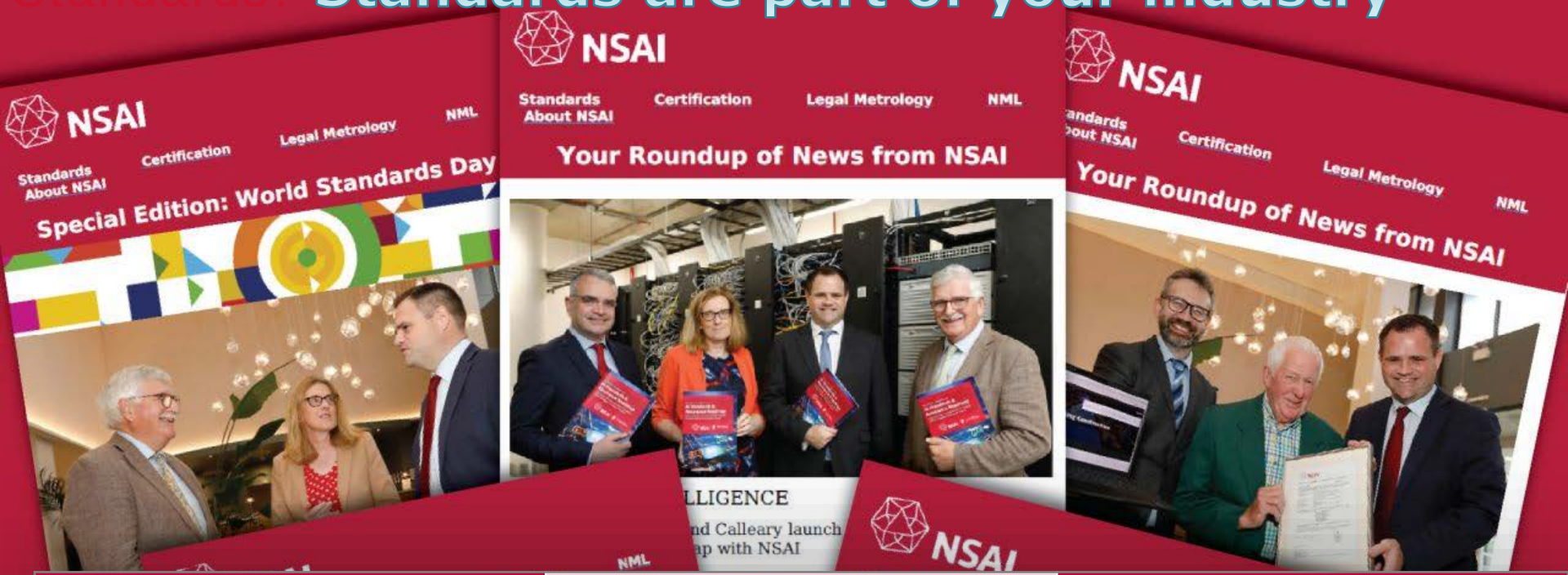
Standards? Standards are part of your industry



You can see the Standards as they develop

You can be part of the Standard as it develops

National Standard Bodies are here to help you

Thank you.

WWW.NSAI.IE

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Search "NSAI"

Current Trends in International Standards Supporting Research in Additive Manufacturing (Part 2)

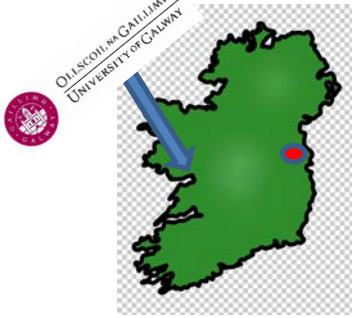
3D Printing, High-Tech Manufacturing & Advanced Engineering Day 1
28th May 2024
RDS, Dublin

Dr Noel Harrison

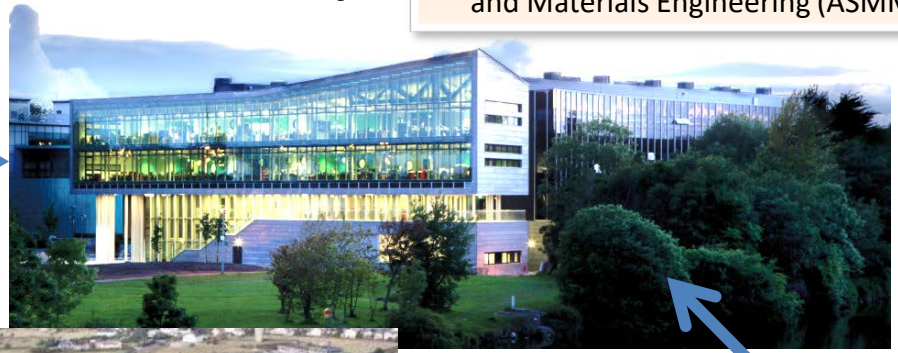
University of Galway & I-Form Advanced Manufacturing Research Centre

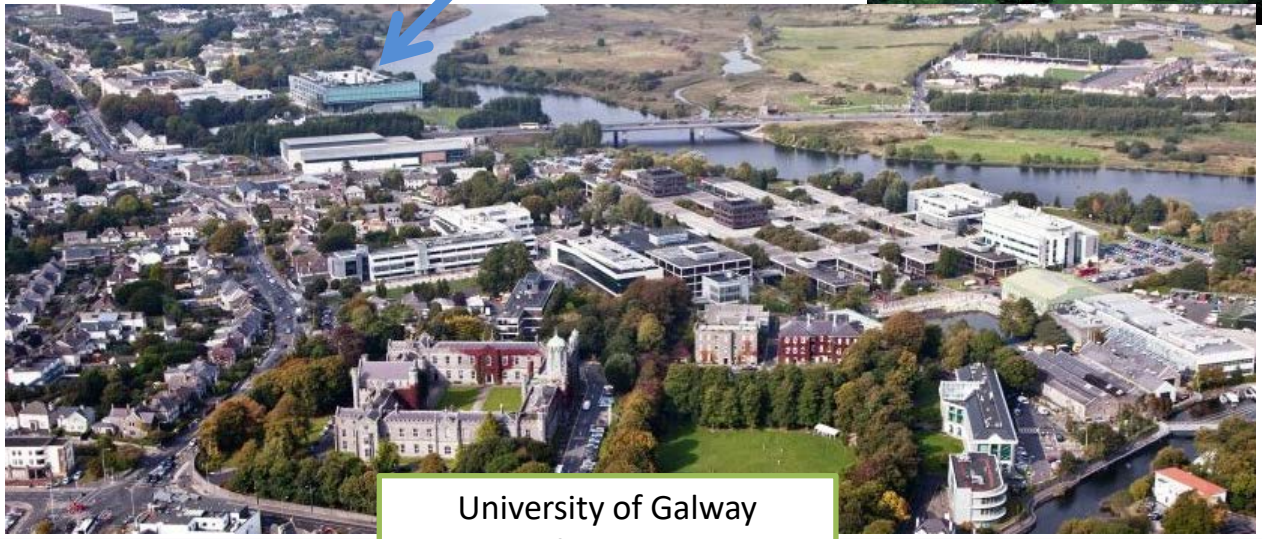
University of Galway

Advanced and Sustainable Manufacturing and Materials Engineering (ASMME)



Alice Perry Engineering Building





University of Galway Campus

Advanced Manufacturing Lab

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I-Form Advanced Manufacturing Research Centre
ASMME
Ryan Institute
Ollscoil na Gaillimhe University of Galway

I-Form

Advanced Manufacturing Research Centre

Our Vision

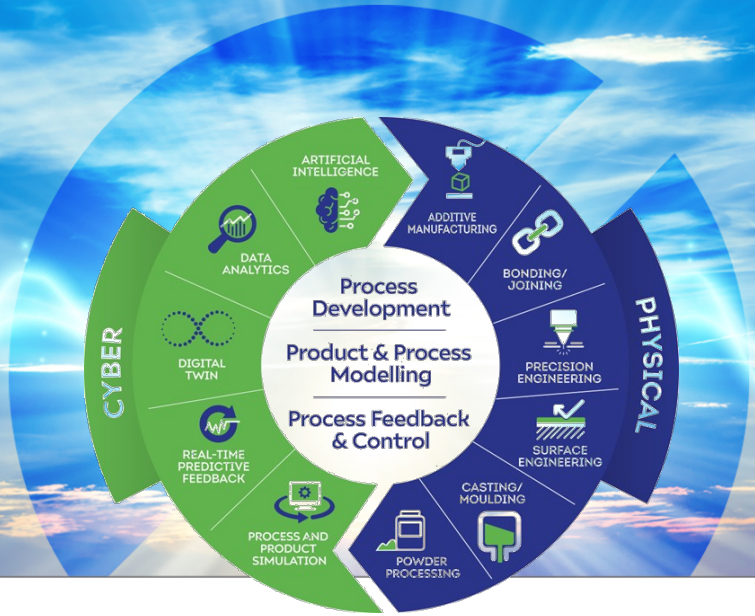
- To be a global leader in advanced manufacturing research & innovation

A World Leading SFI Research Centre

Science Foundation Ireland sfi For what's next

Our Mission

- Shape the future of advanced manufacturing through high-impact research into the application of digital technologies to materials processing



Core Research

- Digitalisation and **Sustainability** in Advanced Manufacturing
- Advanced Materials Processing beyond AM

HOST INSTITUTION

UCD DUBLIN

PARTNER INSTITUTIONS

DCU · Ollscoil na Gaillimhe University of Galway · Trinity College Dublin, Coláiste na Tríonóide, Baile Átha Cliath, The University of Dublin · Atlantic Technological University · SETU · Maynooth University · nibrt · University of Limerick, Ollscoil Luimnigh

FUNDED BY:

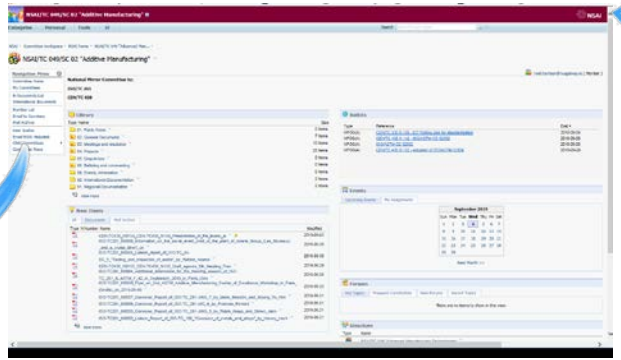
Science Foundation Ireland sfi For what's next

I-Form is an SFI Research Centre funded under the Science Foundation Ireland Research Centres Programme.

What's happening with AM Standards….. in Ireland?

- NSAI established mirroring committee NSAI/TC 049/SC 02
  - Barry Cox: Secretary; Noel Harrison: Chair
  - Meetings for Irish based industry and academic stakeholders
  - Training in standards and standards development processes
  - Access to LiveLink for document review and voting
  - Access to and voting at ASTM/ISO Plenary Meetings

ISO-ASTM JG67



NSAI

NSAI/TC 049/SC 02

ASTM INTERNATIONAL & ISO

ASTM F42

ISO/TC 261 (CEN/ TC 438)

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Sample AM-Related ISO Standards Development

- ISO/TC 207 Environmental Management (est 1993)
  - Mostly concerned with auditing, labelling, management systems
  - ISO/TC 207/**SC 5 Life cycle assessment** activity**:**
    - Published = 16 (inc ISO 14001 family)
    - In development = 5
    - Participating members = 56
  - ISO/TC 207/**SC 7 Greenhouse Gas & Climate change** activity**:**
    - Published = 17 (inc ISO 14064 GHG Reporting, ISO 14067 Carbon footprint)
    - In development = 5
    - Participating members = 60
- ISO/TC 323 Circular Economy (est 2018)
  - Terminology, assessing circularity, product circularity data sheet
  - Mirrored by NSAI/TC 66/SC1 (est 2019) (Chair: Geraldine Brennan IMR)
  - ISO/TC 323 **Circular Economy** Activity:
    - Published = 4
    - In development = 2
    - Participating members = 75
- **Liaisons and ISO collaborations between sustainability and AM TCs underway.**
  - Draft docs on PBF powder reuse standards from ASTM side

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Challenges with Standards Involvement

- How to find the time?
  - Involve others and delegate
  - Share the work and reward
- How to fund it?
  - Standards dedicated funding
  - SFI Centre- research aligned
- How to contribute?
  - Align standards development activity with research activity and vice-versa

StandICT.eu

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ASMME
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Ollscoil na Gaillimhe University of Galway

Opportunity and Outcomes

- Open invitation!
  - Become an expert / advisor
    - (New streamlined NSAI approval process)
  - Highly efficient process
    - Excellent NSAI support and management
    - Remote and online portal based input
  - Be aware and influence imminent standards
  - Become an **ACTIVE** expert / lead for your company!
  - Propose new topics - Drive future work items
  - Networking opportunities
  - Funding available for engagement in ISO standards
  - Date for your diaries
    - Next ASTM-ISO **AM meeting is in Coventry, 9th -13th Sept 2024**
    - For more details and access - contact us!

Thank You:

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