VAMAS

Developing internationally accepted best practice to accelerate innovation and trade of advanced materials technologies

Prof Fernando Castro
VAMAS Chair

….Supporting Global Growth

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1982 Versailles

8th - G7 Economic Summit of the GATT*

- Pierre Trudeau
- Wilfried Martens
- Francois Mitterand
- Helmut Schmidt
- Giovanni Spadolini
- Zenko Suzuki
- Margaret Thatcher
- Ronald Reagan

VAMAS

Formed as one of 18 cooperative projects to stimulate **world trade** in new technologies using **advanced materials** through **pre-standards research**

- only one surviving and growing

* GATT – Global Agreement on Tariffs and Trade

Image source: http://www.lescarnetsdeversailles.fr/2016/04/la-republique-dans-les-meubles-du-roi/

VAMAS

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trade in new technologi
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- only

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Scientific Cooperation Endorsed at Summit

By DAVID DICKSON

+ See all authors and affiliations

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Article Info & Metrics eLetters

—News and Comment—

Scientific Cooperation Endorsed at Summit

Largely at the prompting of President Mitterrand, science and technology have been placed on the international agenda

Paris. One of French President François Mitterrand's most significant—if least noticed—diplomatic successes at the recent Williamsburg summit meeting was to obtain a commitment to greater collaboration in scientific and technical research between the seven nations represented. The commitment took the form of an endorsement by the heads of state of the conclusions of a working party set up at Mitterrand's direct prompting after last year's summit at Versailles.

On the surface, the working group's conclusions contain little that is new or unexpected, which may explain its relative neglect by the media outside France when it was published last March. Its report is prefaced by a recapitulation of familiar arguments in favor of international scientific collaboration and free

Keyworth. "It is in the U.S.'s interest to have broader participation, more planning, and more sharing in long-term research."

Initial U.S. reaction to President Mitterrand's proposals at the Versailles summit was skepticism. The proposals were contained in a rambling speech about the need to establish a new international division of labor in high technology. Part of the U.S. Administration—particularly, it is widely said, the Department of Commerce—saw the French President's keen interest in stimulating international cooperation in technology as little more than an attempt to provide multilateral, government-backed competition to the private sector.

Washington quickly rejected this particular goal. Yet Mitterrand's proposals

battle. But we were not in favor of that type of approach. Instead, we adopted a very British, pragmatic attitude by establishing a list of practical projects which might be of interest to two or more countries."

By following a strategy that was concrete, realistic, and flexible, the working group successfully straddled the political gap between Mitterrand's interventionist position (broadly supported by Japan and Italy) at one extreme, and the United States' free-trade position (adopted by West Germany and, to a lesser extent, by the United Kingdom) at the other. It was also able to keep the United States sweet by including a reference to the need to restrict the transfer of militarily significant technology to Soviet bloc countries

- Pierre Trudeau
- Wilfried Martens
- Francois Mitterand
- Helmut Schmidt
- Giovanni Spadolini
- Zenko Suzuki
- Margaret Thatcher
- Ronald Reagan

* GATT – Global Agreement on Tariffs and Trade

Image source: http://www.lescarnetsdeversailles.fr/2016/04/la-republique-dans-les-meubles-du-roi/

VAMAS

VAMAS
Versailles Project on Advanced Materials and Standards

VAMAS

To promote world trade by innovation and adoption of advanced materials through international collaborations that provide the technical basis for harmonization of measurement methods, leading to **best practice, reference materials and standards**

Canada . France . Germany . Italy . Japan . UK . USA . EC . Brazil . Mexico . Chinese Taipei . South Africa . Australia . Korea . India . China

1982 1983 2007 2008 2013

…celebrating 40+ Years

Collaborations - MOUs with Other Organizations

APMP Asia Pacific Metrology Programme

WMRIF World Materials Research Institute Forum

ISO International Organization for Standardization

Bureau International des Poids et Mesures

IEC

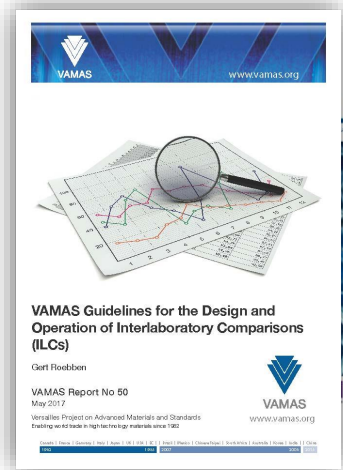
iea International Energy Agency

VAMAS – Key Activities

1. **Foresighting** – bringing together experts to understand stakeholder needs and requirements for advanced materials

2. **Global collaboration** – organising global collaborative projects to establish best practice, share information and accelerate standardisation

3. **Dissemination** - disseminating trends, best practice and reference materials to support standardisation, innovation and world trade of advanced materials.



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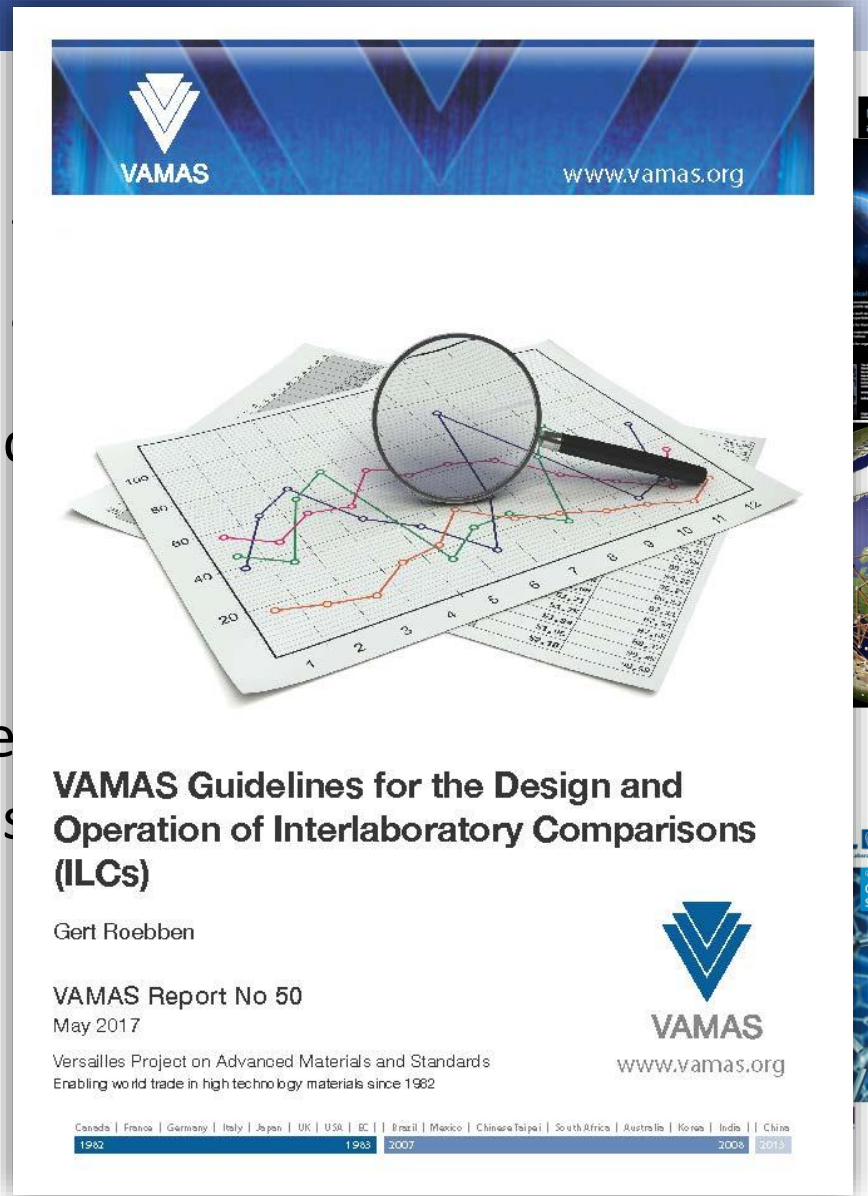
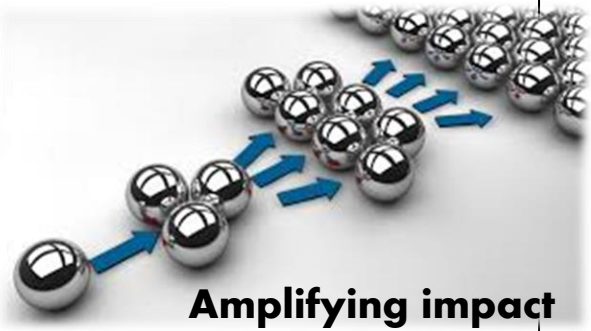


How do stakeholders benefit?

- Insights into new standards for materials
- Insights into novel materials technologies
- Access to a global network of experts.

- Opportunity to define and learn best practice in testing and characterisation of advanced materials.
- Develops skilled workforce and benchmark capability
- International agreement on testing and characterisation before standards are available



- Reduces risks of adopting advanced materials
- Accelerates the standardisation process
- Facilitates world trade in materials

Bridging the gap

Increasing pace of innovation ⟺ increasing gap between need and availability of standards

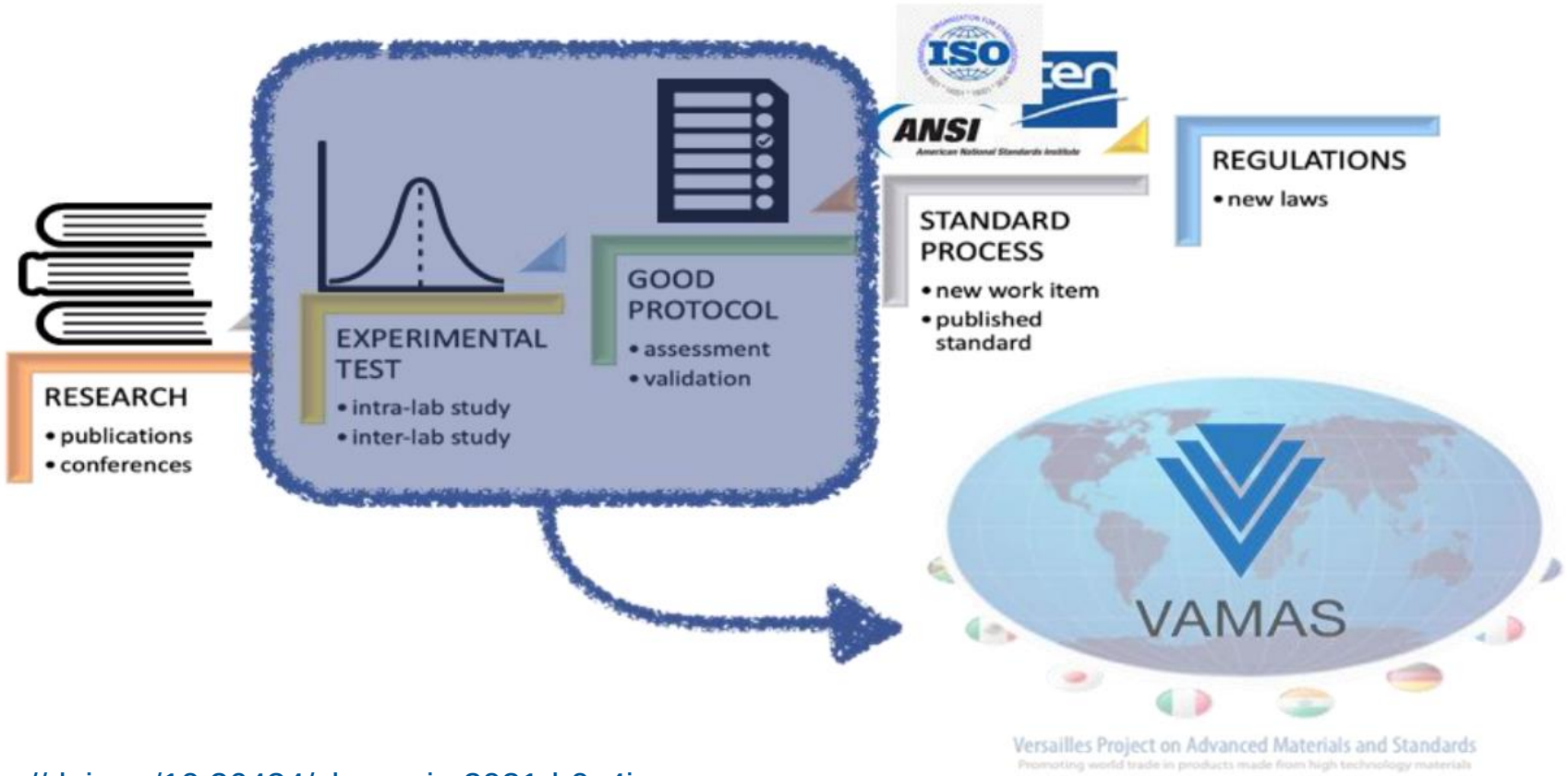


Image extracted from https://doi.org/10.26434/chemrxiv-2021-h0z4j

VAMAS Management

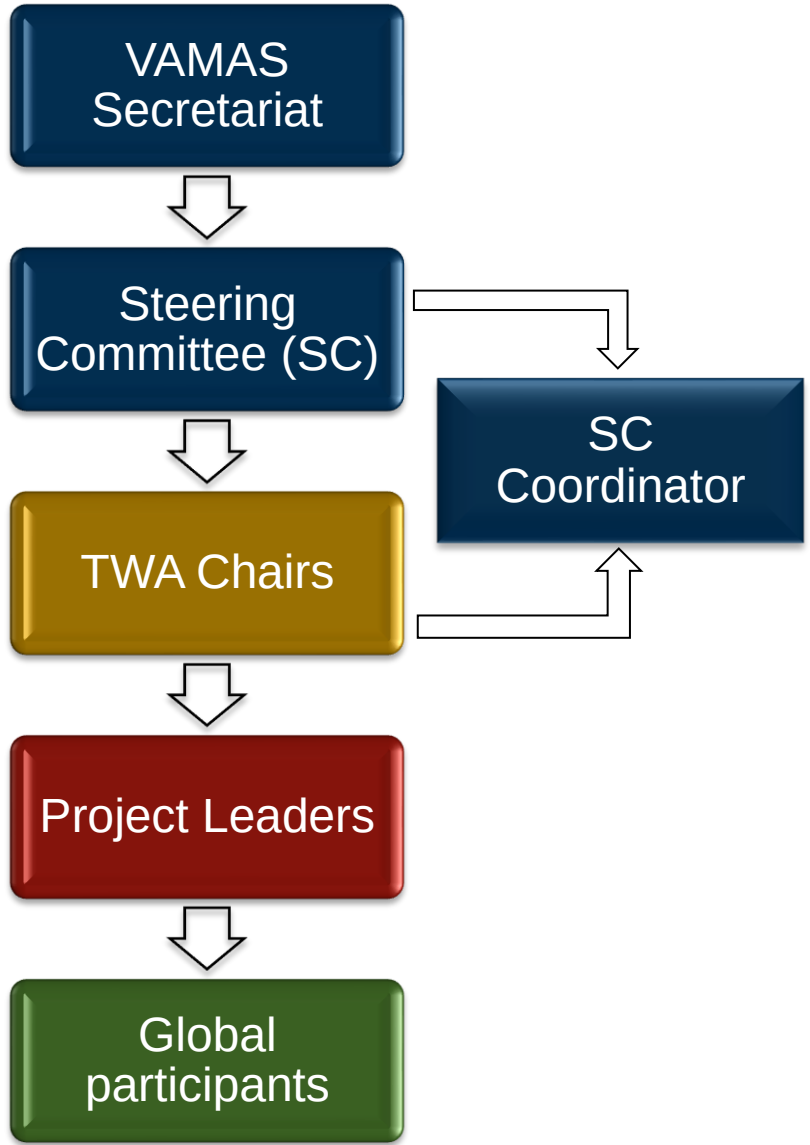
International Chair and Secretary

Three SC representatives from each member region

Appointed by the SC

Globally based

Open to volunteers from both member and non member regions



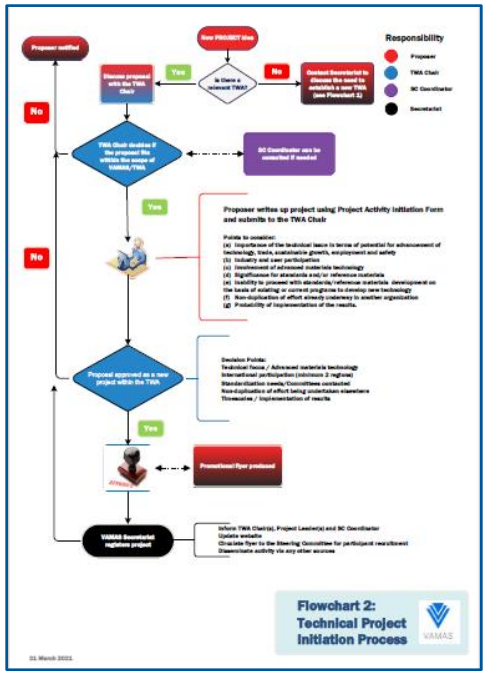
Who can participate?

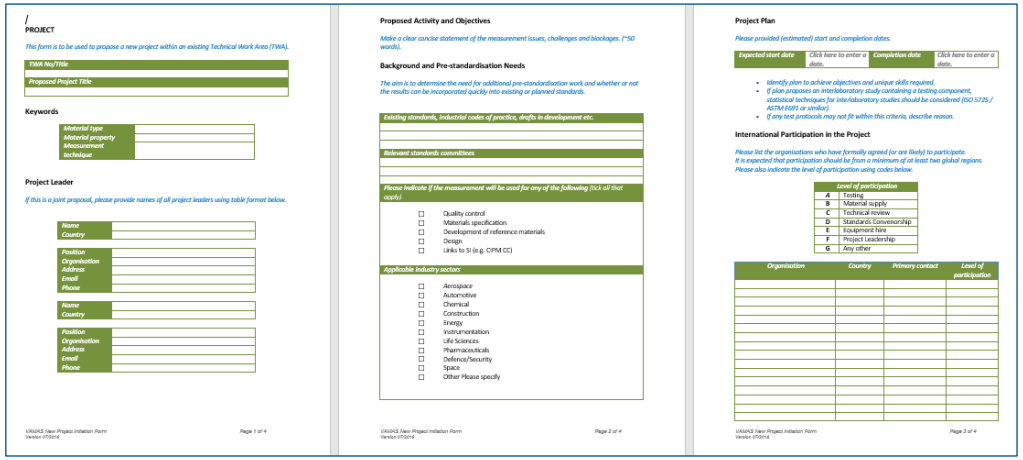
- Any organisation, with expertise and capability in the area of study can participate and there is no fee
- Participants can be from either VAMAS member or non-member regions
- Participants fund their own involvement in the study
- Test materials for the interlaboratory exercises are supplied free of charge
- The VAMAS website lists studies that are open for participation
- Contact the Project Leaders, TWA Chair or the region Steering Committee Representative for more information.

How does one initiate a new Technical activity?

Points to consider

1. Importance of the technical issue in terms of potential for advancement of technology, trade, sustainable growth, employment and safety
2. industry and user participation
3. Involvement of advanced materials technology
4. significance for standards and/or reference materials
5. non-duplication of effort already underway in another organization
6. probability of implementation of the results





- **New projects**
  approved by TWA Chair

- **New TWA**
  presentation to the SC
  approved by the SC (voting – 1 per member region)

info@vamas.org

VAMAS

Currently active Technical Work Areas (TWA)

VAMAS

Surface Chemical Analysis	Quantitative Microstructural Analysis
Polymer Composites	Solid Sorbents
Superconducting Materials	Synthetic Biomaterials
Properties of Electroceramics	Graphene and Related 2D Materials
Creep, Crack and Fatigue Growth in Weldments	Raman Spectroscopy and Microscopy
Polymer Nanocomposites	Thermal Properties
Nanoparticle Populations	Self Healing Ceramics
Printed, flexible and stretchable electronics	Micro and Nano Plastics in the Environment

VAMAS

Examples from Technical Work Areas (TWA)

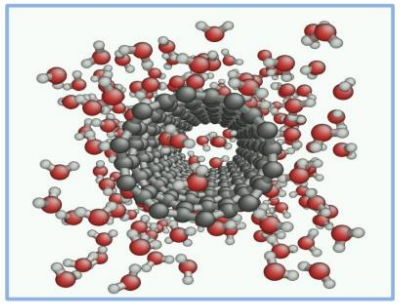
CODATA-VAMAS working group

VAMAS

"How do we know which nanomaterial is under discussion? Which of its features are important?"

"How to determine if two nanomaterials are equivalent?"

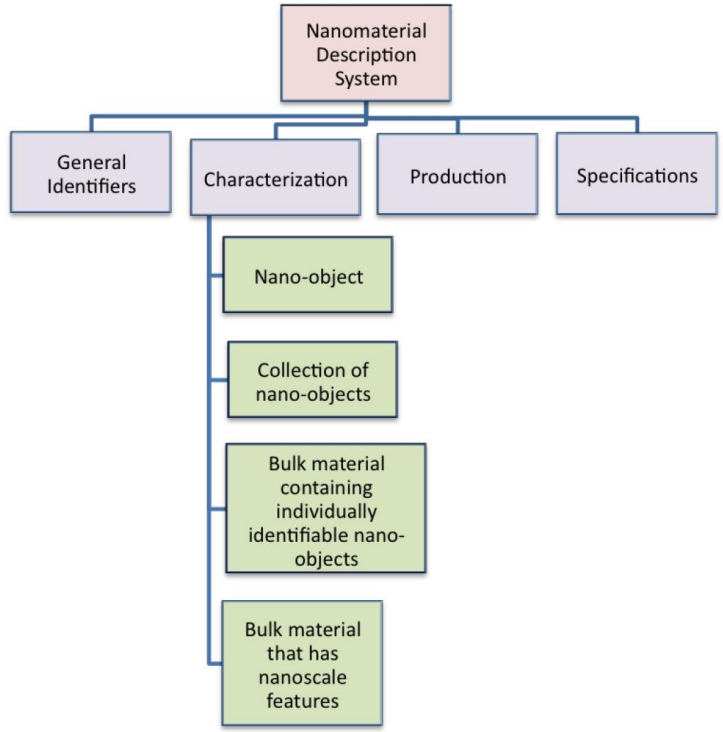
Uniform Description System for Materials on the Nanoscale



Prepared by the CODATA-VAMAS Working Group
On the Description of Nanomaterials
www.codata.org/nanomaterials

Version 2.0
25 May 2016

Using the UDS: Major Information Categories Used to Describe a Nanomaterial		
Title	**Part**	**Description**
Introduction, Use, Definitions, and Framework	1	Introductory material about the UDS including general definitions and the overall framework
Characterization of an individual nano-object	2	A set of measurement results that taken together uniquely characterizes the physical, chemical, structural and other characteristics of a nano-object
Characterization of a collection of nano-objects	3	A set of measurement results that taken together uniquely characterizes the physical, chemical, structural and other characteristics of a collection of nano-objects
Description of bulk materials	4	The description of the bulk materials either containing nano-objects or having features on the nanoscale
Production of nanomaterials	5	A set of general and specific data information that describes the production of a nanomaterial. The production of a nanomaterial is assumed to have a distinct initial phase followed by one or more post-production phases
Specification of nanomaterials	6	A set of detailed information about specification documentation according to which a nanomaterial has been produced or documented
General identifiers for nanomaterials	7	The general terms used to name and classify a nanomaterial
References		
Appendix A	8	Information about the descriptors used for a measurement



The International Council for Science: Committee on Data for Science and Technology (www.codata.org)
VAMAS (www.vamas.org)

New project proposed – extend progress on unique identifiers for nanomaterials

VAMAS

VAMAS

Nanoparticle Populations
Technical Work Area 34

Project 17

Line notation and unique identifiers for nanomaterials and groups of nanomaterials

Objectives
Clear, unambiguous reporting of the identity of a nanomaterial is a complex and not completely solved task. A standardized line notation encoding important physicochemical characteristics will improve this situation. It could replace other suboptimal unique identifiers and provide better machine readability. Specific objectives are:

- Identify and agree on a set of characteristics needed to be encoded in the line notation.
- Generate a technical specification and software implementation compatible with the chemical line notation InChI and its extensions endorsed by IUPAC.
- Test the line notation on a set of diverse nanomaterial classes to guarantee broad applicability but also to define the applicability domain of the identifier.

Background
VAMAS and CODATA jointly developed the Uniform Description System (UDS) for materials at the nanoscale to define minimal reporting guidelines for physicochemical characterizations of nanomaterials. This can be used as the basis for a line notation, which encodes all this information (or parts of it) in a compact form that is easy to extract from different documents, enabling comparisons, supporting searches for specific nanomaterials and corresponding data, and identifying similar materials. A first prototype was published recently as an extension of the InChI.

Standardization Needs
The new line notation (NInChI) will improve the UDS by providing a unique identifier for a material or group of materials and, at the same time, a summary of the major characteristics of the material and its provenance. Standards based on the UDS should be updated accordingly.

Work Programme
- Dataset curation to develop sets of real-world nanomaterials libraries to challenge the implementation and coding of the NInChI as much as possible.
- Monthly virtual hackathons with nanomaterials experts and IUPAC NInChI working group experts to develop workable suggestions for how to encode different aspects of nanomaterials descriptors.
- Face-to-face workshops.

Deliverables and Dissemination
- Specification of a line notation for nanomaterials (NInChI, multiple development cycles) as extension to the IUPAC International Chemical Identifier (InChI).

Call for Participation

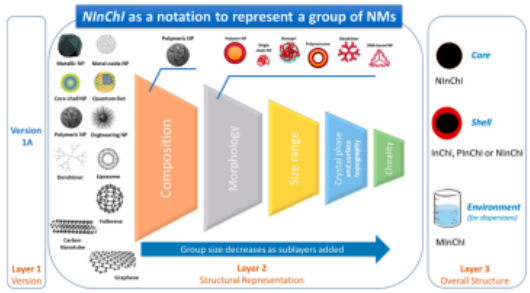


Illustration of the *NInChI* as a notation to represent a particular group of NMs (reproduced from Lynch at al., https://doi.org/10.3390/nano10122493)

- Standard implementation to be used in data management and reporting tools
- Update(s) of the UDS to integrate the NInChI and additional reporting requirements identified during the development of the NInChI.
- Update of ASTM E3144-19 and other standards based on UDS to include NInChIs and other reporting requirements.

International Participation
Current participants include volunteers from countries on all continents. More volunteers with expertise is specific nanomaterial classes (composition, coating,...), standards for nanomaterial characterization, and machine-readable identifiers and representations are welcome.

Funding
Participants fund their own involvement in the project. Organization of workshops can be financially supported.

Project Status
The project started in June 2022 and will continue for a duration of 24 months.

For more information on participation, please contact:

Prof. Iseult Lynch
Project lead
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Project lead
Seven Past Nine, Slovenia
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www.vamas.org

August 2022

Nanoparticles – colloidal concentration

VAMAS

VAMAS TWA34 Nanoparticle Populations
Project 10 Measurement of colloidal concentration

INNANOPART Innovative Nanoparticle Metrology

EURAMET

Why Measurements of Colloidal Concentration are needed?

- Control over nanoparticle-based materials production and life cycle
- Control of product properties
- Effective risk assessment
- Compliance to recent EU regulation

Issues before project started

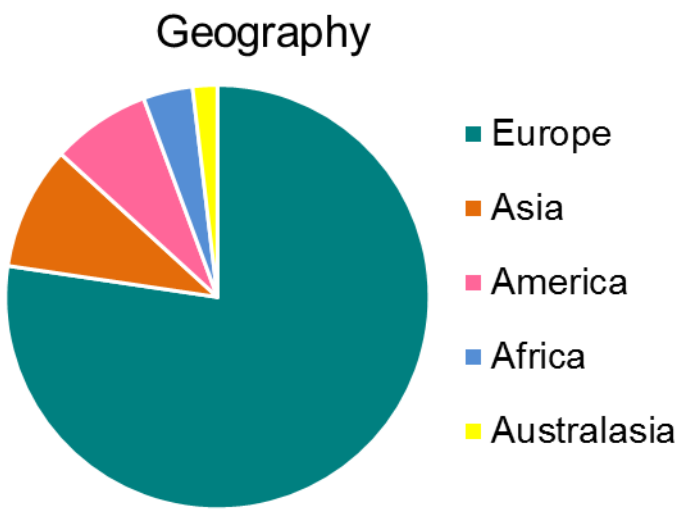
- No nanoparticle reference materials available
- Lack of validation of laboratory methods
- Lack of best practice in sample preparation for accurate measurements

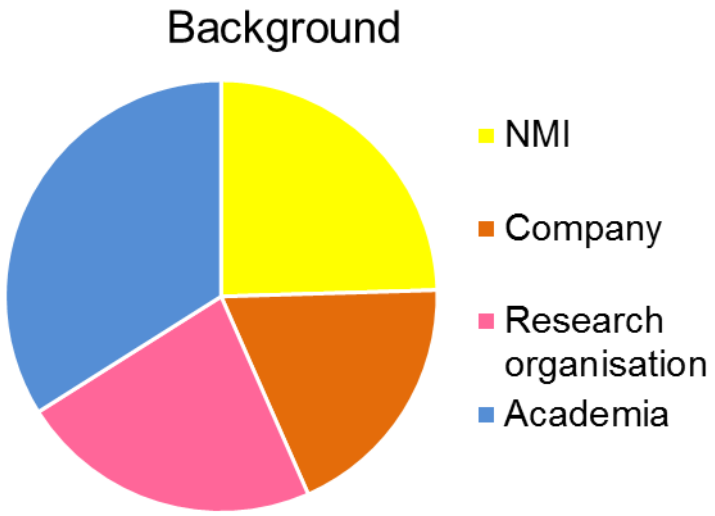
Nanoparticles – colloidal concentration

Aim:

1) Comparability and reproducibility of measurement of number concentration of nanoparticles with techniques of UV-Vis, spICPMS, PTA and DCS (plus SAXS).
2) Disseminate best practice for sample preparation and measurement.

Participation: 53 institutions, 73 measurement reports.

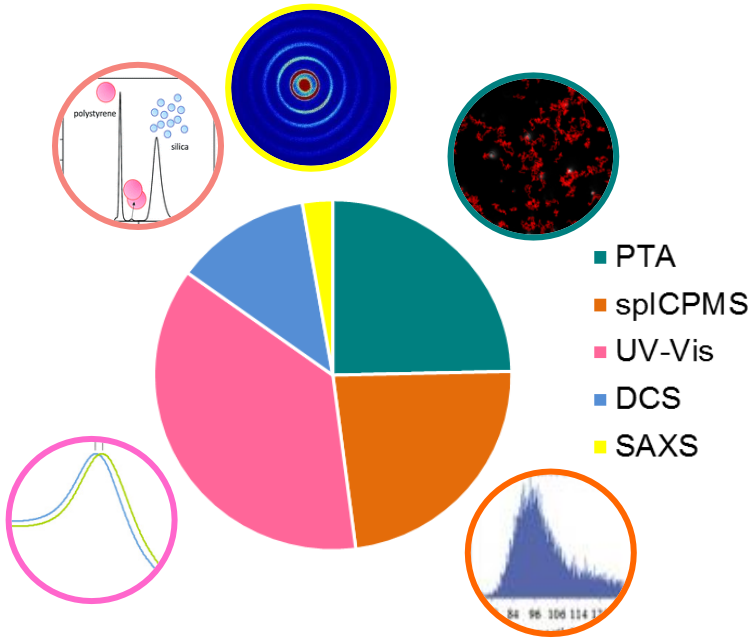


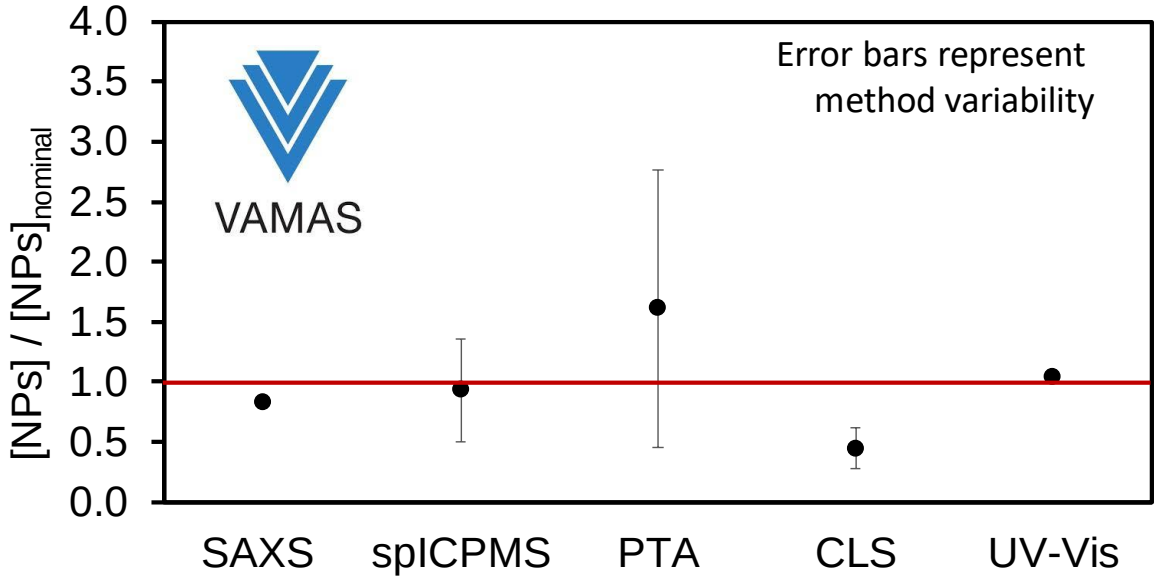


Participant pack

Sample: 30 nm colloidal gold

Nanoparticles – colloidal concentration





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Cite this: *Nanoscale*, 2022, **14**, 4690

Versailles project on advanced materials and standards (VAMAS) interlaboratory study on measuring the number concentration of colloidal gold nanoparticles†

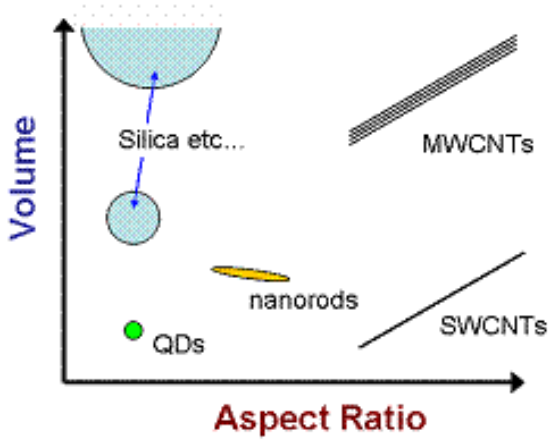
- For the first time, methods were benchmarked with respect to a common reference material.
- Methods taken-up by instrument manufacturers and other industries to improve QA/QC.
- Reference material now commercially available
- Outcomes being translated into ISO documentary standards

VAMAS TWA34 Nanoparticles Populations

VAMAS

Active Projects

- **PROJECT 13:** Analysis of nano-objects using field flow fractionation
- **PROJECT 14:** Crystallinity of cellulose nanomaterials by Powder X-ray Diffraction and Rietveld Modelling
- **PROJECT 15:** Measurement of particle size and shape distribution of bipyramidal titania including deposition from liquid suspension
- **PROJECT 16:** Measurement of (relative) number concentration of bimodal silica nanoparticles including deposition from liquid suspension
- **PROJECT 17:** Line notation and unique identifiers for nanomaterials and groups of nanomaterials



More information

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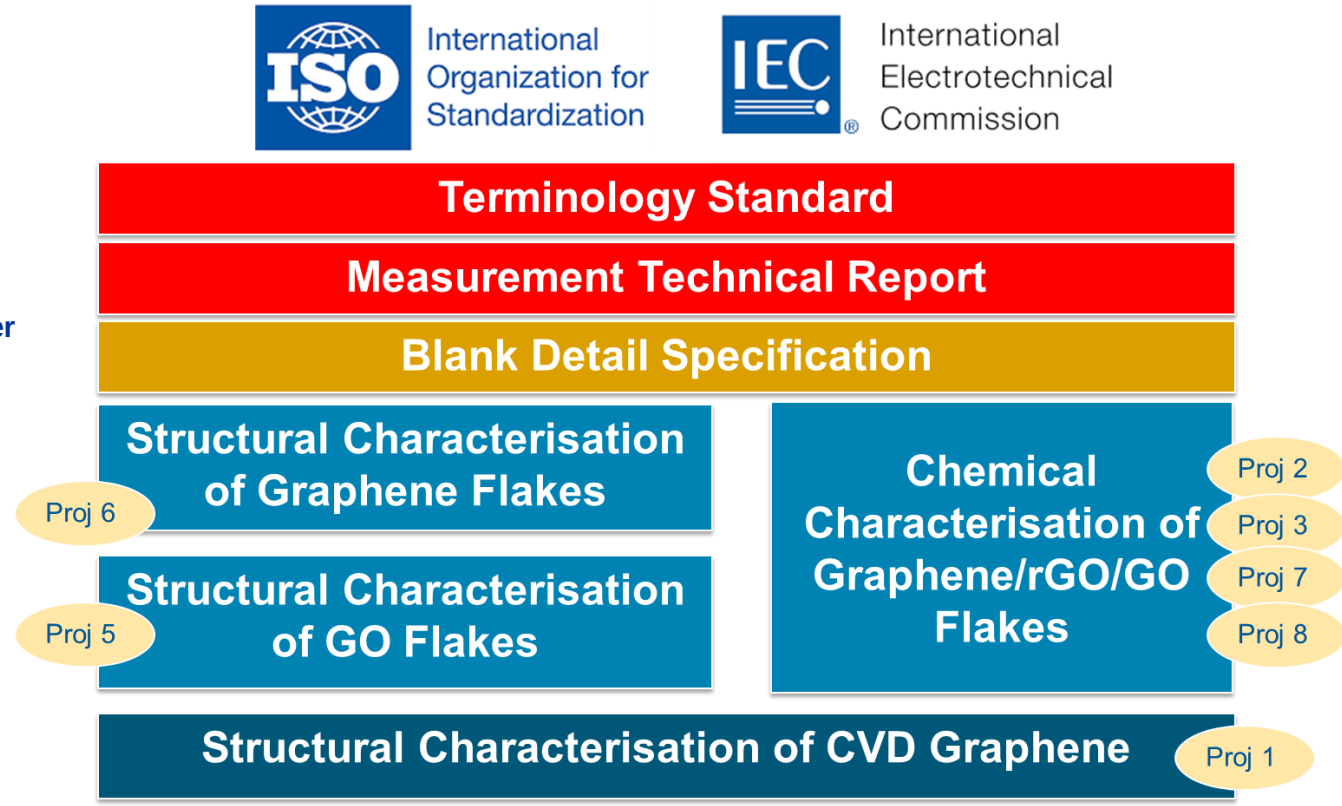
TWA41 Graphene and related 2D Materials

VAMAS

Example of close collaboration between ISO and VAMAS
VAMAS work helping accelerate standardisation

Current Projects:

- Project 1: **Structural characterisation of CVD-grown graphene (Raman spectroscopy)**
- Project 2: **Measurement of the metal impurities of a graphene powder (ICP-MS)**
- Project 3: **Elemental analysis and oxygen content of a graphene powder (XPS)**
- Project 4: **Graphene Characterisation - Online Consultation Survey**
- Project 5: **Thickness measurements of Graphene Oxide flakes (AFM)**
- Project 6: **Specific surface area of graphene flakes (BET)**
- Project 7: **Functional groups present for graphene flakes (FTIR)**
- Project 8: **Characterisation of graphene/rGO/GO powders by Thermogravimetric Analysis (TGA)**



TWA41 Graphene and related 2D Materials

VAMAS

New projects in this area since 2022

9. Number of layers of a CVD grown graphene sheet using Transmission Electron Microscopy (TEM) and Selected Area Electron Diffraction (SAED)
10. Determination of the S, F, Cl and Br content of graphene powders by Combustion Ion Chromatography (C-IC)
11. Determination of disorder and number of layers of graphene flakes by Raman Spectroscopy
12. Lateral size and thickness measurement of few-layer graphene flakes using scanning electron microscopy (SEM) and atomic force microscopy (AFM)
13. Determining the lateral size of graphene oxide flakes using scanning electron microscopy (SEM)
14. Measurement of spatial homogeneity in two-dimensional semiconductors

More information

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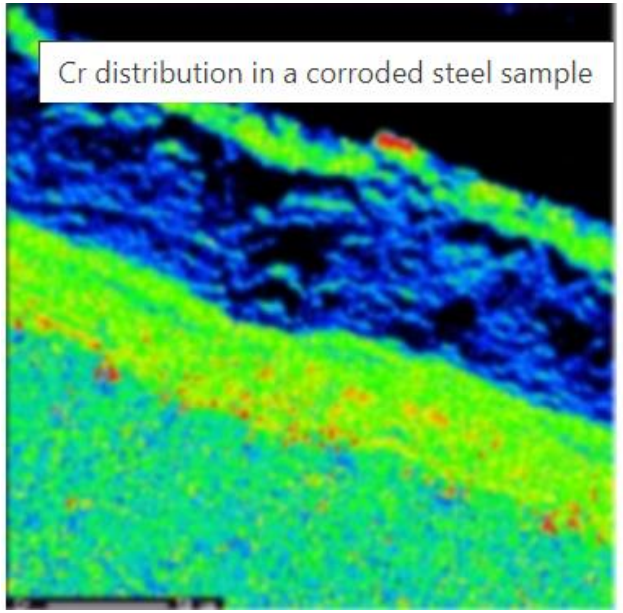
Dr. Andrew Pollard andrew.pollard@npl.co.uk

TWA37 Quantitative Microstructural Analysis



PROJECT 1 : Determination of reproducibility and repeatability of grain size measurement by Electron Back Scattered Diffraction (EBSD)

PROJECT 2 : Investigation of sharpness of scanning electron microscope (SEM) images

PROJECT 3: Development of guidelines for reproducible TEM specimen preparation by focused ion beam processing

More information

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TWA40 Synthetic Biomaterials

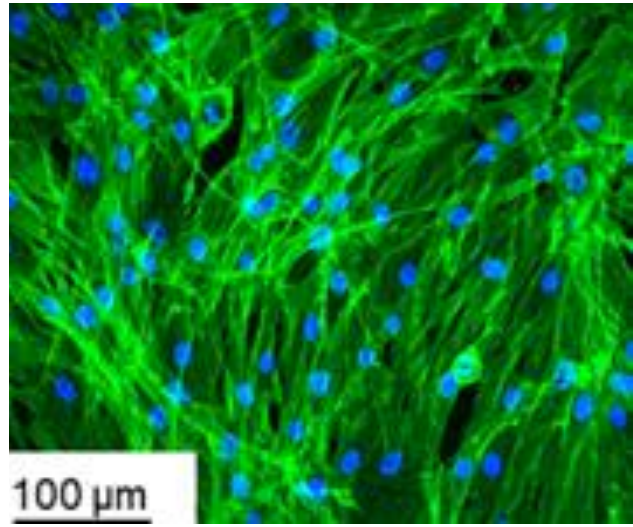
VAMAS

Active Projects

5. An intracellular distribution number of virus-like particles per cell
6. Comparability in the thermal stability of a protein antibiotic

Covid 19 Projects

8 Physicochemical profiling of virus-like particles as reference materials for vaccine development and virus particle diagnosis
9. Validating biosensor binding kinetics for microorganism antigens
10. Quantification of an SI-traceable reference material in cells post-transfection



More information

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TWA45 Micro and nano plastic in the Environment

VAMAS

Measurement needs for microplastics

VAMAS

19 October 2022
INRiM - Istituto Nazionale di Ricerca Metrologica
Strada delle Cacce 91, 10135
Torino, Italy

Background

Micro and nanoplastics contamination in food and the environment are growing fast and there are concerns about the potential consequences for the environment and human health. To have reliable data are mandatory for the society, to meet regulatory requirements and, in particular, for the decision-makers.
International interlaboratory studies to validate and assess the protocols for the sampling, detection and modelling the phenomena is a priority for standardisation. In a wide-spread industrial and commercial reality, many aspects must be studied to manage the flow of waste material from different sectors and industries

Technical themes

Environmental and societal impacts
Harmonization of technologies, processes, policies
Civil society engagement to a circular economy
Waste resources information
Waste treatment technologies
Business models and coordination between value chain actors
Development of projects to measure the environmental impacts of materials in terms of
- Safety
- Energy
- Efficiency
- Recyclability

Objectives

VAMAS Technical Working Area 45, **'Micro and Nano Plastics in the Environment'** is offering the scientific community the platform to assess concerns and support the initiation of international projects in developing reliable protocols to support future standardisation.

The Versailles Project on Advanced Materials and Standards (VAMAS) was formed in 1982 with the mission of fostering world trade in products that depend on advanced materials through international collaborations that provide the technical basis for harmonization of measurement methods, codes of practice and standards.

Scientific Committee:
Andrea Giovannozzi (a.giovannozzi@inrim.it)
Laura Depero (laura.depero@unibs.it)

Local organisers:
Luca Boarino (l.boarino@inrim.it)
Natascia De Leo (n.deleo@inrim.it)

INRiM ISTITUTO NAZIONALE DI RICERCA METROLOGICA

www.vamas.org

Results of VAMAS Survey Regarding Microplastic Issues

*Stefania Federici[§#], Monika Rani[§#], Laura E. Depero[§#]**

https://doi.org/10.26434/chemrxiv-2021-h0z4j

VAMAS

Micro and Nano Plastics in the Environment
Technical Work Area 45

Project 02

Development of standardized methodologies for characterisation of microplastics with microscopy and spectroscopy methods

Objectives

- Validate the performance of microscopy and spectroscopy methods (µ-IR, µRaman) and thermogravimetric methods (Py-GC/MS, TED-GC/MS) to measure the particle size distribution, shape, mass content, particle number concentration of microplastic particles (MPs)
- Achieve precision and accuracy of the results for comparability and for pre-standardization and harmonization.

Background

The European Horizon 2020 has organized five projects for research on plastic micro– and nanoparticles into one European Consortium (CUSP, cusp-research.eu/). Within these projects slightly different objectives are set, however, the main common aim is to obtain a set of standard methods for reliable micro– and nanoplastic characterization for risk assessment and better regulation. For the validation of methods, instrumentation and parameters for microplastics an interlaboratory comparison (ILC) is organized to start in January 2023.

asurement methods

proposed measurement methods
ude thermoanalytical (Py-GC/MS, TED-
MS) and spectroscopic ones (µ-IR and µ-
nan). With thermoanalytical methods the
s content of the polymer in the sample can be determined. With spectroscopic methods the particle number concentration and the polymer identity can be obtained.

Standardisation needs

There is a need for standardized measurements of microplastic size distribution, shape, mass content and number concentration, since regulation requires reliable set of methods and accurate, precise results. The ILC is intended to complete the entire sequence of MPs analysis with the aim to include the evaluation of results and methods into new ISO standards.

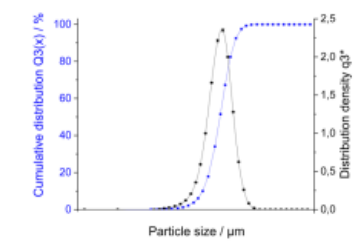
Work Programme

Pressed pills with a well-defined mass of MPs will be prepared within the Horizon Europe PlasticsFatE project (www.plasticsfate.eu/) by BAM and will be provided to participants together with protocols for sample preparation, analysis and reporting. Final data compilation, statistics and analysis will be undertaken by BAM.

Deliverables and Dissemination

This interlaboratory study will be disseminated at scientific conferences and in a peer-reviewed scientific journal. It is planned to publish the developed measurement protocols and ILC data in a peer-reviewed journal (contributions of all ILC participants to be included in the Acknowledgement section). Further, the gained results for the microplastic number concentration, mass, particle size distribution, including sample preparation protocols for the microscopic, spectroscopic and thermogravimetric methods will be proposed to be included in future standardisation projects under ISO/TC 61 Plastics and ISO/TC 61/SC 5 Physical-chemical properties.

CALL FOR PARTICIPATION



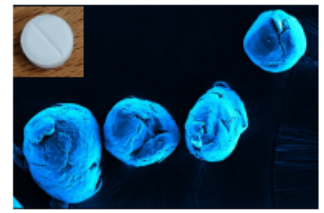


Fig. 1 Generic size distribution of secondary microplastic particles (left) and SEM image (filtered "hot-cyan") on the right. On the top left of the SEM image a photograph of a pressed pill containing a well-defined amount of microplastic particles is shown.

International Participation

Current participation includes volunteers from countries from all continents. Additional participants are welcome to join the ILC via VAMAS according to VAMAS procedures.

Funding

Participants fund their own involvement in the project.

Project Status

The project is due to start in January 2023 for a duration of 6 months.

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Final remarks
Open innovation and Standardisation

Collaboration

Developing global networking opportunities with peers

Validation

Benchmarking your measurements and capability

Scientific Activity

Able to propose new projects based on your own needs

Impact

Supporting industry needs for international standardisation

VAMAS in 2021-2022

- ❑ 40+ Active international projects
- ❑ 300+ global participants
- ❑ 40+ countries

VAMAS work has led to

- ❑ 100s international standards
- ❑ New products and services
- ❑ Dissemination of best practice to 1000s of organisations

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Versailles Project on Advanced Materials and Standards

VAMAS

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NPL National Physical Laboratory

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