Exploratory Technical Efforts

Technical Work Area 0

Call for Expression of Interest

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Project T7

Mechanical properties of composites and metals at cryogenic temperatures

Objectives

- To map and connect international laboratory capabilities for mechanical characterisation of polymer matrix composites and metallic alloys at cryogenic temperatures from 77 K to ≥ 4 K.
- Document and compare current test practices, instrumentation, and protocols, identifying limitations in repeatability, reproducibility and interoperability.
- Develop a landscape report of standardisation needs to improve measurement reliability and uncertainty evaluation.
- Promote knowledge exchange within the cryogenic materials and standards communities.

Background

Cryogenic mechanical properties are increasingly critical for technologies such as liquid hydrogen systems, superconductivity, fusion and accelerator facilities, space applications, and quantum technologies. However, comparable and reliable mechanical property data at cryogenic temperatures remain limited, particularly for advanced alloys and composite materials. Current testing methods often rely on bespoke apparatus, locally developed procedures, and limited calibration or traceability frameworks. As a result, data generated by different laboratories are often non-comparable, with measurement uncertainties that are poorly quantified or inconsistently reported. These limitations hinder material adoption and qualification, slow technology deployment, and reduce confidence among designers, manufacturers, and regulators.

Scope & standardization needs

The project will focus on landscaping the standards needs for mechanical property measurements in the range 77 K to ≥ 4 K, covering: (1) Tension, (2) Flexure, (3) Fracture (4) Compression (5) Shear. Key standardisation-relevant topics include temperature measurement & control, specimen design & preparation, load introduction & gripping, strain measurement, uncertainty evaluation and reference material use. Measurements for both metallic and composite materials will be considered, recognising their differing sensitivities to temperature, strain rate, and test configuration.

Work programme

Participating organisations will contribute through: **(1)** Capability mapping – identification of existing cryogenic mechanical testing facilities, temperature ranges, methods, and instrumentation; **(2)** Practice review and comparison – documentation and inter-comparison of in-use test methods, specimen geometries, and data-reduction approaches; and **(3)** Reference materials and uncertainty approaches – Identification of suitable reference materials and practical strategies to improve inter-laboratory comparability.

Deliverables and dissemination

The project outputs will include: **(1)** A technical summary report identifying priority gaps and recommendations for future standardisation; and **(2)** identification of suitable test materials for future efforts, with selection based on availability, relevance, and the existence of baseline data suitable for benchmarking rather than extensive database generation. **(3)** Dissemination through VAMAS, including presentations at relevant Technical Working Areas and engagement with ISO/ASTM committees where appropriate. All outputs will be pre-competitive and openly shared within the VAMAS framework.

Funding & status

Participants fund own involvement in the study. The project is actively seeking members, with flexible levels of contribution.

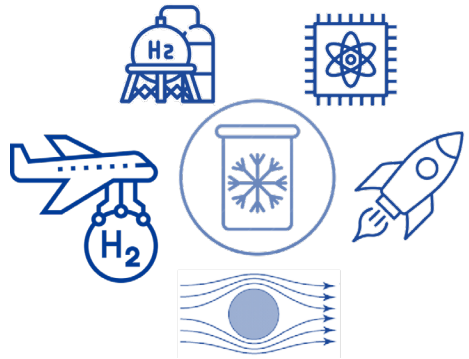

Figure: Application of cryogenic materials in energy, aviation, superconductivity, space and quantum applications

Register your interest

Project Leaders:
Michael Gower
National Physical Laboratory, UK
michael.gower@npl.co.uk

Dr Stefanos Giannis
National Physical Laboratory, UK
stefanos.giannis@npl.co.uk

TWA 0 Chair
Dr. Stephanie Hooker
shooker@nist.gov

www.vamas.org

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