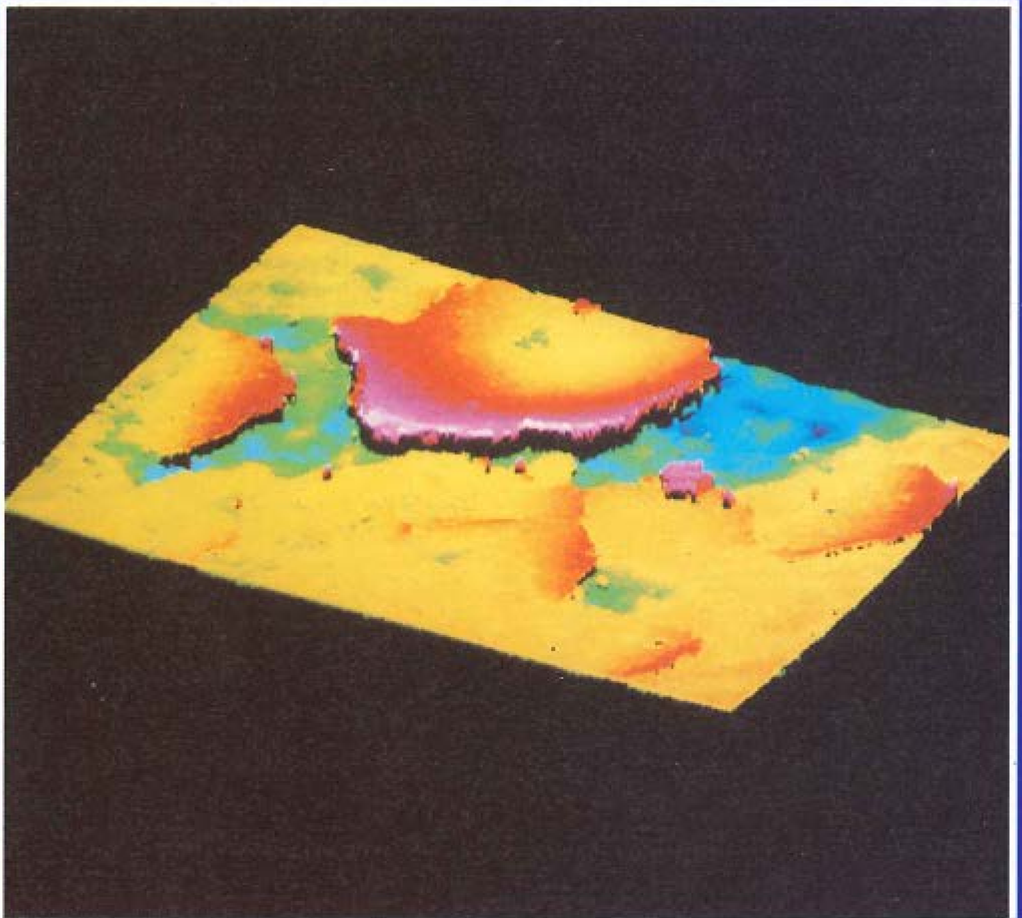
VAMAS



BULLETIN NO. 15
January 1992

Versailles Project on Advanced Materials and Standards
• Canada • France • Germany • Italy • Japan • UK • USA • CEC •

VAMAS

The Versailles Project on Advanced Materials and Standards (VAMAS) supports trade in high technology products through international collaborative projects aimed at providing the technical basis for drafting codes of practice and specifications for advanced materials. The scope of the collaboration embraces all agreed aspects of enabling science and technology – databases, test methods, design methods, and materials technology – which are required as a precursor to the drafting of standards for advanced materials. VAMAS activity emphasises collaboration on pre-standards measurement research, intercomparison of test results, and consolidation of existing views on priorities for standardisation action. Through this activity, VAMAS fosters the development of internationally acceptable standards for advanced materials by the various existing standards agencies.

ISSN 1016-2178

Cover: Colour coded topographical view of worn alumina surface obtained by Scanning Optical Microscopy.

Photograph by courtesy of National Physical Laboratory, Teddington, UK

VAMAS

• Table of Contents •

Foreword

The original MoU for VAMAS was signed by the G7 countries and the CEC for five years, 1987-92. You will be pleased to learn that we are well advanced for extending the Agreement for another five years to 1997. At the time of going to press, the Governments of Canada, Italy, Germany, Japan, UK and USA have formally agreed to the extension and I am optimistic that France and the CEC will also continue their support.

The new phase will start at the next Steering Committee meeting in Berlin, at the end of which the VAMAS Secretariat will be transferred to NIST in the USA and Dr Harry Rook as Chairman and Mr James Early as Secretary will then be guiding VAMAS. For the next phase, some changes in the structure and operation of VAMAS have been planned. These are outlined in a feature article (pages 6-9) in this Bulletin, which also contains information about new areas of work under development.

A significant development for the future is a new MoU between VAMAS and ISO under which suitable VAMAS outputs will be published as joint ISO/VAMAS Technology Trend Documents before an international standard can be drafted and processed via the normal route. This would enable industry to benefit quickly from VAMAS results. On behalf of VAMAS, I am expecting to sign the MoU in early summer.

In December 1991 our Japanese colleagues organised an International Symposium on Pre-Standards Research for Advanced Materials (ISPRAM '91) in Tokyo immediately prior to the Steering Committee meeting. Most of the International Chairmen of the VAMAS TWAs were present to review the work. During the three days, nearly 65 technical papers were presented in four parallel sessions, and over 250 participants, many from industry, attended the meeting. I would like to congratulate the organisers for the immense success of the event.

The current issue of the Bulletin does not contain the normal TWA progress reports but instead has brief statements highlighting dissemination mechanisms for each of the TWAs. This is a topic which the new Secretariat will be reviewing quite soon after the start of the new phase of VAMAS.

Kamal Hossain
Chairman

• Feature Article •

CURRENT STATUS AND FUTURE TRENDS
ISPRAM '91

Dr M K Hossain, Chairman of VAMAS Steering Committee
NPL, Teddington, Middlesex, UK, TW11 0LW

1 Introduction

New developments in materials technology are widely recognised to be providing industry with substantial opportunities for creating competitive products to meet demands in an increasingly open international market. This can bring significant economic benefits as well as help to satisfy important social needs, for example, in energy conservation, protection of the environment, and health and safety. However, for effective and wide diffusion of the technology, appropriate methods of materials specification and evaluation, and codes of practice are needed. Appreciation of this fact was at the heart of the origin of VAMAS, the Versailles Project on Advanced Materials and Standards.

VAMAS arose out of the Economic Summit meeting of the Heads of State held at Versailles in 1982 and operates under a Memorandum of Understanding signed in 1987 by the Group of seven Economic Summit nations and the Commission of the European Community. The overall objective of VAMAS is to help promote trade in high technology products through international collaboration in pre-standards research in order to generate the technical basis from which commonly acceptable standards and specifications for advanced materials can be developed.(1)

2 Current Structure and Organisation

VAMAS is managed by a Steering Committee (SC) which has up to three nominated representatives from each of the participating nations and the CEC. Pre-standards research under VAMAS is organised into Technical Working Areas (TWAs) which are approved by the SC and led by international chairmen. So far fourteen TWAs have been established although one TWA has already completed its work. TWAs are usually involved with more than one project concurrently and adopt a dynamic approach whereby new projects are initiated as existing projects are completed. All technical work is carried out on the work-sharing principle with no funds transferred between countries.

What is particularly encouraging is the fact that over 350 different research groups have participated enthusiastically in the programme, including some from eight non-summit countries. Industrial, academic and government laboratories have all been involved and in several cases industry has provided additional support by contributing materials for testing and round robin exercises.

3 Scope of Technical Work

In the fourteen TWAs, the scope of collaboration embraces all the important aspects of pre-standardisation research including the development of the basis for a materials classification scheme, reliable and reproducible test methods, specifications for materials property determination, reference materials and database formats. Nearly 60 projects in these TWAs are covering organic, inorganic and metallic materials as well as thin films, coatings and composites. Materials behaviour relating to thermal, electrical, chemical, mechanical and physical properties is being investigated, demonstrating the success of VAMAS in generating a wide spectrum of project activities.

4 Achievements of the Initiative

Achievements of VAMAS can be measured in two important respects: (a) Scientific and Technical; (b) Influence on Standards.

Papers which are presented at the later sessions in this Conference give a more detailed picture of the quality of the scientific and technical results obtained under VAMAS, but it is evident from numerous publications in scientific journals of international reputation that the output has been of a high standard. By way of illustration[2], one can point to:

- the work done in wear metrology defining critical test parameters and methodology to obtain reproducible data;
- the development of accurate and traceable calibration methods based on fundamental understanding of electron spectroscopy techniques applied to surface analysis;
- the understanding of the properties and behaviour of complex polymer blends;
- the analysis of the mechanisms of delamination crack growth in polymer composites;
- the new knowledge of the fracture toughness of cryogenic steels and technical ceramics;
- the assessment of the effects of impurities in weld characteristics;

With regard to achievements on the standards front, two national standards have been published on test methodology for wear of materials. In the surface chemical analysis area, a standard data transfer format has been developed and although it is not published by a Standards Body, the format has been accepted by the surface analysis community and is being used widely. Similarly, under VAMAS, reference materials and guidelines for testing have been produced, of clear value for materials evaluation by industry. Also notable is a standard on creep crack growth measurements for ferritic steels which is due to be published shortly. It is estimated that already technical bases have been established from which another ten or so standards are at various stages of development.

No international standards have yet been achieved by VAMAS, but we should bear in mind that the important advantage of the VAMAS approach is that a resultant standard has been derived from a harmonised body of technical information acceptable to the international community. Significantly, there are currently very few international standards on advanced materials. For example, there is no Technical Committee in ISO dealing with advanced ceramics except for medical implants as a specific type of product. VAMAS, however, is making an important impact in this direction as evidenced by the case where, following a recent Japanese initiative, the work of VAMAS TWA 2 has been considered so important that a new Technical Committee in ISO has been set up. This will accelerate the development of international standards with a strong input from VAMAS.

More generally, VAMAS has brought researchers from different countries in contact with each other, which has led to other forms of collaborations and awareness. The cost benefits of obtaining a large body of information by the collaborative participation of up to eight summit countries and, with their agreement, non-summit countries in certain areas, are self-evident. The work is often beyond the resources of any one member state.

5 Future Trends

The VAMAS MoU ends formally next year but plans are at an advanced stage to extend the Agreement by another five years to 1997. This has been supported strongly by an independent review completed earlier in the year(3). With a new phase in sight, it is essential that we review the future operation and strategy for VAMAS taking into account relevant developments since the inception of the initiative.

It is clear that during the last ten years the concept of pre-standards research has become well established and, in the advanced materials field, pre-standards research has become more widespread in the industrialised countries. An important factor responsible for this is the acceptance that standards and specifications will play a crucial role in the development of markets, nationally and internationally.

In the standards world tremendous changes are taking place, especially in Europe - these stem from the 31 December 1992 deadline set for the unification of the European markets into a single market requiring an unprecedented number of common standards. Naturally, this has generated much debate about the need to enhance and speed up the production of truly international standards in preference to various geographic sectors developing their own standards. In this respect VAMAS is in a unique position to foster international cooperation.

During the first phase of VAMAS, TWAs and project proposals have evolved in an ad-hoc manner. Although the results have been satisfactory, it is now appropriate that future VAMAS activities are developed by identifying, in a structured way, priorities and requirements for future standards to ensure that the limited resources available for pre-standards research are most effectively utilised. Priorities will be determined by wider and regular consultation with national and international standards committees, industry and other key organisations involved in standards-related activities. Wherever possible, direct links with standards committees will be established through common membership of individuals in VAMAS TWAs and standards committees. This approach also has the advantage that VAMAS results will be converted more readily into standards.

Indeed TWA 14, concerned with the development of a unified classification system for advanced technical ceramics, has made substantial progress in this direction and may serve as a model for the future. Already CEN and ASTM have endorsed this VAMAS activity and have agreed to take direct standards action as soon as the VAMAS group has finalised its proposal for a unified scheme. Laying down of the groundwork in advance for standards action has required good cooperation between the VAMAS group and the standards committees.

More generally, VAMAS is negotiating with ISO/IEC to sign MoUs which would enable suitable VAMAS outputs to be published as joint ISO-IEC/VAMAS Technology Trend Documents before a standard can be drafted and processed via the normal route. In the relatively slow world of standardisation, this would mean industry can benefit quickly from VAMAS results.

Several changes are expected to be introduced shortly with the aim of rationalising Technical Working Areas under VAMAS into key themes, generating more projects, streamlining project approval, introducing a standard scheme for monitoring progress, developing a consistent publications policy, and increasing publicity of VAMAS work in industry.

6 Conclusions

The independent review on VAMAS concluded that VAMAS has made commendable progress and is fulfilling a unique role in fostering international collaboration in pre-standards research. Enthusiasm and technical competence of participants are key strengths of VAMAS and there is little doubt that if we can build on the strengths in the new phase, it will have much to contribute in the development of harmonised standards and promotion of international trade in products made from advanced materials.

7 References

1 VAMAS: Aims and organisation (1986).
2 VAMAS Bulletin No 12 (1990).
3 An Independent Report on VAMAS, R J E Glenny, J A Blair and R Tanka (1991).

VAMAS: THE NEXT PHASE

VAMAS Secretariat, Division of Materials Metrology
NPL, Teddington, Middlesex, UK, TW11 0LW
Tel: +44 81 943 6298
Fax: +44 81 943 2989

1 Background

The first five years of international collaborative research within VAMAS have produced substantial achievements in both furthering the scientific understanding of materials and test techniques and establishing the technical bases for standards development.

In anticipation of the imminent start of a new five-year phase of VAMAS, the Steering Committee is evaluating the current organisational structure of VAMAS, to take into account developments in the first phase and to facilitate future progress. The aims are to strengthen the work carried out through VAMAS, to prioritise and structure the utilisation of the finite resources for pre-standards research and to foster the energy and enthusiasm of participants which are key to the technical achievements produced within VAMAS.

This article provides some background information on how the Steering Committee is approaching the organisation of the next phase of VAMAS, and aims to bring new developments to the attention of the materials measurement and wider scientific communities before the structure is finally agreed and put into place.

2 Steering Committee

The UK, through the National Physical Laboratory, has provided both the chairman and secretariat of VAMAS for the last three years of the first phase. In June 1992, this responsibility will pass to the USA. Dr Harry Rook, the assistant director of the Materials Science and Engineering Laboratory, NIST, will be the new chairman, and NIST will also provide the secretariat for VAMAS.

3 Thematic Structure

During the next phase the work will continue to be grouped into Technical Working Areas (TWAs), consisting of a number of clearly defined projects with nominated project leaders. However, one of the most important considerations in the development of the organisational structure of VAMAS is the rationalisation of these TWAs into key themes.

Five themes and the following alignment of the current TWAs within the themes have been suggested.

I	METALS AND MMC	TWA 11, TWA 13,	Creep Crack Growth Low Cycle Fatigue
II	POLYMERS AND PMC	TWA 4, TWA 5, TWA 12,	Polymer Blends Polymer Composites Efficient Test Procedures for Polymer Properties
III	CERAMICS AND CMC	TWA 3,	Ceramics
IV	TEST TECHNIQUES (non-material specific)	TWA 1, TWA 2, TWA 6, TWA 7, TWA 8,	Wear Test Methods Surface Chemical Analysis Superconducting & Cryogenic Structural Materials Bioengineering Materials Hot Salt Corrosion Resistance
V	MATERIALS CLASSIFICATION AND DATA	TWA 10, TWA 14,	Materials Databanks Unified Classification System for Advanced Ceramics

The thematic structure will allow the development of a systematic mechanism for coordinating the TWAs. It is proposed that several members of the Steering Committee will be assigned to each theme as "rapporteurs", enabling them to keep in close contact with the progress of the TWAs within their theme. The "rapporteurs" will guide the TWAs within the theme and report to the Steering Committee on progress. TWAs will also be encouraged to develop several projects which can run in parallel.

4 New Technical Working Areas

4.1 Project Pro forma

As part of the more systematic approach to the initiation of technical working areas a new project pro forma is under consideration by the Steering Committee. The new form will require the project proposer to provide details on the objectives, deliverables, participation, and timescales of the project. Other important information required will be a justification of the necessity of the work, including the predicted level of usage of the measurement and details of any active standards committees in the field plus information on specific dissemination routes which have been identified for the work. The pro formas will be submitted to the Steering Committee for consideration and approval.

4.2 New Work Areas - Framework

The Programme Sub-committee, led by Dr Gould, is overseeing the development of a new programme of TWAs within the thematic structure. It is intended that this will assist in developing a rolling portfolio of work with new TWAs/projects continually being completed and initiated.

In order to target the future technical activities of VAMAS effectively, all of the countries participating have been asked to indicate which topics are of particular interest for future work.

Further, a recent debate organised by BCR within Europe concerning perceived needs for prestandardisation research, identified a number of work areas worthy of consideration by VAMAS.

- Low cycle fatigue
- Crack arrest testing
- Fatigue crack growth
- Temperature measurement and control
- Dynamic load calibration
- Fracture mechanics of ceramics
- Fracture of creep brittle materials
- Statistical analysis
- Fracture of welds (thick and thin)
- Validation of extensometry
- Metal matrix composites

From both these sets of results, and more detailed questioning, five main priorities for technical work have been identified:

1. Metal Matrix Composites
2. Engineering Ceramics
3. Polymer Composites
4. Crack Initiation and Growth
5. Fatigue/Thermal Fatigue

4.3 New Work Areas - Specific Activities

A number of potential new TWAs are currently being actively considered.

Metal matrix composites - Two provisional chairmen and an initial programme of work have been proposed and it is expected that the Steering Committee will approve the formation of this new TWA in June.

Statistical aspects of round robins - This project will underpin the work of all of the TWAs and therefore is likely to be set up as an advisory group rather than a TWA. There is to be a workshop in Berlin, at BAM, coinciding with the next Steering Committee meeting, to assess the requirements more closely.

Large scale fracture testing - The TWA would address the relation of results of crack arrest tests on full scale specimens to life-time predictions from tests on small scale specimens. Work is under way to further define requirements.

Non-destructive testing - Potentially an important TWA, but key people have not yet been identified.

Measurement of thin films and coatings - This is considered to be a very important field and work is being carried out to determine which project areas should be selected for inclusion in this proposed TWA.

• Interlaboratory Studies •

M P Seah, Division of Materials Metrology
NPL, Teddington, Middlesex, UK, TW11 0LW
Tel: +44 81 943 6634
Fax: +44 81 943 2989

Interlaboratory Studies in VAMAS

The purpose of this note is to address the points we should consider in devising interlaboratory studies or round robins within the framework of VAMAS. This is a first draft to provide a clear perspective of points to which readers are encouraged to respond to in order to produce a refined statement.

VAMAS provides the technical base for pre-standards work. What do we mean by standards? Standards, in general, include aspects of usefulness (such as the design of a particular power plug configuration) as well as aspects of measurement and its associated uncertainty. In relation to work, within VAMAS and other frameworks, I shall concentrate on the latter aspect. In considering this, certain terminology will be used. Where possible I shall use the definitions given in the International Vocabulary of Basic and General Terms in Metrology (ISO, 1984) as shown in the Annex.

All projects should have a mission statement. This is necessary for both the originator and receiver to have a clear idea of the intended objectives of the project. It should be recognised that both round robins and interlaboratory studies may have a very wide range of possible objectives which may be clarified according to the scheme below. First, at (1) and (2), we distinguish between the above studies.

(1) The traditional or true sense of the round robin concerns one object which is sequentially handled by a series of observers. Thus, the first objective would be the study of this single reference artefact by a series of laboratories. This type of project itself may have a series of possible objectives.

(2) In instances where the test or measurement itself may alter the artefact, separate artefacts must be analysed by each laboratory in an interlaboratory study (this may be done in parallel, whereas the round robin would be sequential). In this case the first and most important aspect is to define the uncertainty which arises from the use of one sample from a notionally homogeneous batch of artefacts.

Within either type of study are the four classes (a) to (d) below:

class (a) **All laboratories believe they can calibrate the artefact(s) with known uncertainties.**

All do the calibration and then a final statement of uncertainty may be based on the ensemble of results. Not all laboratories may be measuring the same parameter, if more than one parameter is involved, but all laboratories providing a calibration must be able to provide their data with full traceability to national or international standards. The result is an internationally certified artefact or reference material with known accuracy for international calibration. A spin-off from this type of study may be an improvement in the reference procedures for one or more laboratories if different laboratories claim different values for either the random or the systematic uncertainties.

class (b) **Not all laboratories can calibrate the artefact(s) with traceable uncertainties.**

This type of project is not generally to be recommended as it inevitably has two separate objectives comprised of (a) and (c).

class (c) **Only one laboratory can calibrate with traceable uncertainties.**

In this case the calibrated artefact(s) can only be used to assess the measurement procedures of the other laboratories. Therefore the work can be used to test the validity of the associated reference procedure, its ease of use and relevance as well the accuracy and stability of the calibration for those participating laboratories. It may be that, for instance, one of the participating laboratories shows better precision than the calibration laboratory and in this case the results may also be used to indicate the way to improve the primary calibration.

class (d) **No laboratories can calibrate with traceable uncertainties.**

Projects of this type are valuable to show the extent of problems existing between laboratories and to define the parameter space in which a future traceable calibration should be established.

There are, of course, other types of study and class that may be envisaged but the above illustrates a basic framework. It is clear that in any laboratory measurement the final result has an uncertainty which includes

(i) the variability of the measurand,
(ii) the random and systematic uncertainties of the measuring instrument and method, and
(iii) the errors of the operative.

By retrieving the artefact, or its remains, after the interlaboratory study and by retrieving the original instrumental outputs, items (i) and (ii) may often be reduced and the magnitude of (iii) determined. Consideration should be given to all of the sources of uncertainty before the study so that sufficient written instruction is given to the participants that they provide the fullest extent of information to interpret the results. In studies in TWA 2 we attempt to incorporate redundant information to provide lie and consistency tests.

Care must be taken in constructing the interlaboratory test as discussed by B Roebuck in the VAMAS Round Robin (Aide Memoire). These aspects are fully dealt with in that report and the references contained therein.

Care must be given to the mode of expression and analysis of the final uncertainties. Do not treat correlated uncertainties in the same way as uncorrelated ones. With correlated uncertainties the final uncertainty may be greater or smaller than any of the individual component terms. To work out the result one needs the covariance matrix as exampled in the CODATA 1986 analysis of the uncertainties of the fundamental constants.

Two very simple examples illustrate the need to consider more than simple global uncertainties.

Children may be measured for height h(t) as a function of time t to an accuracy Δh using a scale affixed to the classroom wall. There are three errors in Δh which are the precision, the scale error (including non-linearity) and the zero point error. For measuring rates of growth the first two are needed and not the last unless the heights are measured once a year as the group moves from classroom to classroom (the scale fixture may be different). In the second example, for the measure of a relation y(x) where y is related to x by $y=y_0x^n$, with data in the interval x_1 to x_2, a fractional uncertainty in y may be simply n times the fractional uncertainty in x for $x_1 < x < x_2$ if y_0 and n are known. In general fitting we often do not know y_0 and n and their determination is an objective of the work. Statistical analysis gives us the uncertainties in both y_0 and n. We cannot however simply return these uncertainties to the partial differential equation for the above summing uncertainties in quadrature to deduce its accuracy for prediction since the uncertainties in y_0 and n will be anticorrelated. Thus, it is important to state each uncertainty term separately and only to give a combined or total value in relation to a defined end-use.

Annex

Definitions from the International Vocabulary
of Basic and General Terms in Metrology

accuracy of measurement

The closeness of the agreement between the result of a measurement and the (conventional) true value of the measurand.

certified reference material

A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

measurand

A quantity subjected to measurement.

Note As appropriate, this may be the measured quantity or the quantity to be measured.

national standard

A standard recognised by an official national decision as the basis for fixing the value, in a country, of all other standards of the quantity concerned.

random error

A component of the error of measurement which, in the course of a number of measurements of the same measurand, varies in an unpredictable way.

reference material

A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

repeatability of measurements

The closeness of the agreement between the results of successive measurements of the same measurand carried out subject to all of the following conditions:

- the same method of measurement,
- the same observer,
- the same measuring instrument,
- the same location,
- the same conditions of use,
- repetition over a short period of time.

reproducibility of measurements

The closeness of the agreement between the results of measurements of the same measurand, where the individual measurements are carried out changing conditions such as:

- method of measurement,
- observer,
- measuring instrument,
- location,
- conditions of use,
- time.

systematic error

A component of the error of measurement which, in the course of a number of measurements of the same measurand, remains constant or varies in a predictable way.

traceability

The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

transfer standard

A standard used as an intermediary to compare standards, material measure or measuring instruments.

uncertainty of measurement

An estimate characterising the range of values within which the true value of a measurand lies.

Note Uncertainty of measurement comprises, in general, many components. Some of these components may be estimated on the basis of the statistical distribution of the results of series of measurements and can be characterised by experimental standard deviations. Estimates of other components can only be based on experience or other information.

• Technical Working Areas •

Technical Working Area 1

WEAR TEST METHODS

Dr S Jahanmir, NIST, Gaithersburg, MD 20899, USA
Tel: +1 301 975 3671
Fax: +1 301 926 8349

Dr E Santner, BAM, Unter den Eichen 87
D-1000 Berlin 45, Germany
Tel: +49 30 8104 0020
Fax: +49 30 811 2029

Objectives

- To develop internationally agreed wear test methodologies for advanced materials, initially ceramics and inorganic coatings
- To improve reproducibility and comparability of wear test methods
- To characterise wear behaviour of advanced materials

Dissemination

The results of previous projects related to wear test methods were disseminated in several ways. These included items in technical journals, presentations at technical meetings, reports by the National Representatives, and VAMAS publications. The results of interlaboratory tests have been used as a basis for developing a US standard through the American Society for Testing and Materials (ASTM G-99), and a German standard through the German Standards Organisation (DIN 50324). Currently, TWA 1 is working on four projects. The results of these projects will be disseminated in a similar manner to the previous projects, as appropriate.

Technical Working Area 2

SURFACE CHEMICAL ANALYSIS

Dr M P Seah, Division of Materials Metrology
NPL, Teddington, Middlesex, UK, TW11 0LW
Tel: +44 81 943 6634
Fax: +44 81 943 2989

Objectives

- To provide the measurement infrastructure required for setting standard methods of specifying surface chemical analysis
- To develop an agreed base for principles, definitions and equations for relevant aspects of surface analysis techniques
- To identify reference procedures for materials, data, instrumentation and measurement methods

Dissemination

Dissemination is via key international conferences:

- QSA series in UK run by NPL in even years
- QSA series in US run by NIST in odd years
- ECASIA series in Europe in odd years

and by publications in the referenced literature.

Links with standards bodies: ISO TC201 on Surface Chemical Analysis has just been set up by the Japanese who hold the secretariat. VAMAS will liaise with the ISO Committee through national standards committees and direct links with the Secretariat.

Key achievements have been:

- Production of a standard data transfer format - a working standard widely used by the SCA community
- Production of reference materials/spectra for calibration procedures.

CERAMICS

G D Quinn, NIST, Gaithersburg, MD 20899, USA
Tel: +1 301 975 5657
Fax: +1 301 926 8349

Objectives

- To undertake pre-standardisation research on the reliability and reproducibility of test procedures for advanced technical ceramics

Dissemination

Three VAMAS Reports, and three journal reports have been prepared. The forum of publication has been left to the discretion of the coordinating laboratory in each case for the three round robin exercises already completed.

Future plans for publication are as follows:

1. A report on dynamic fatigue of advanced ceramics is being prepared at NIST as a VAMAS Technical Report. It will report the results of the dynamic fatigue (variable rate, flexure strength) round robin.

2. 'The VAMAS Fracture Toughness Test Round Robin on Ceramics'. A new version of this report is under preparation at the Japan Fine Ceramic Center and will incorporate additional results from the USA, Switzerland, and Germany. It will cover the room temperature round robin exercise coordinated by JFCC.

3. A report on the high-temperature fracture toughness round robin that is currently under way will be written by JFCC in 1992 as a VAMAS Technical Report.

4. Joint CEN/CENELEC-VAMAS report for the measurement of grain size.

Technical Working Area 4

POLYMER BLENDS

Dr L A Utracki, NRC/IMRI, 75 boulevard de Mortagne
Boucherville, Québec, Canada, J4B 6Y4
Tel: +1 514 641 2280
Fax: +1 514 641 4627

Objectives

- To provide the technical basis for drafting standard test procedures for new, high performance polymer alloys and blends in 5 complementary technical areas: melt flows, dynamic testing, thermal properties, morphology, mechanical properties

Dissemination

The VAMAS Technical Working Area on Polymer Blends is using a two-pronged approach for the dissemination of data collected during the round robin testing. Firstly, a liberal policy on data publication in scientific journals and conference procedures was adopted. As a result, the TWA activities have generated 24 articles published in internationally recognised, referenced journals; 24 conference communications and nine reports. Secondly, effort was made to collaborate directly with the standardising organisations. Up-to-date the thermal characterisation of polymer blends has been accepted by ISO TC-61 as a New Work Item.

Technical Working Area 5

POLYMER COMPOSITES

Prof C Bathias, Conservatoire Nationale des Arts et Métiers
Dept of Materials Engineering, 292 rue Saint Martin,
75141, Paris, France
Tel: +33 1 40272322
Fax: +33 1 42719329

Objectives

- To assess and refine fracture toughness measurements for delamination crack growth
- To develop test procedures, data presentation and failure criteria for fatigue of continuous fibre composites using flexural and tensile test conditions
- To develop creep test procedures for continuous multidirectional composites

Dissemination

Future plans for publication include:

(a) Joint publications with standards organisations.

(b) A VAMAS Technical report will be produced covering fatigue test results for three materials under both flexure and tension test conditions.

Additionally, several reports have been prepared covering the delamination fracture toughness work and the plan of the fatigue test round robin.

Technical Working Area 6

SUPERCONDUCTING AND CRYOGENIC STRUCTURAL MATERIALS

Professor K Tachikawa, Tokai University, 1117 Kita-Kaname
Hiratsuka, Kanagawa 259-12, Japan
(Guest Researcher of National Research Institute for Metals)
Tel: +81 463 581211
Fax: +81 463 581812

Objectives

- To establish reliable measurement techniques for superconducting materials, initially through the use of round robins on critical current and AC loss measurements in multifilamentary wires
- To establish reliable measurement techniques for cryogenic structural materials, initially through the use of round robins on tensile and fracture toughness measurements

Dissemination

36 scientific papers reporting the results achieved in VAMAS TWA 6 have been published so far. A key paper is: K Tachikawa, The VAMAS intercomparisons in the area of superconducting and cryogenic structural materials, *Advances in Cryogenic Engineering/Materials*, **36A**, (1990),

The VAMAS session has been established as a feature of the International Cryogenic Materials Conference Series.

The TWA keeps a close contact with the TC-90 of IEC which was recently inaugurated. Recommendations from VAMAS TWA 6 will effectively contribute to the future standardisation programmes of IEC.

The final report of the current work of this TWA, consisting of five volumes, will be published successively in 1992-1993.

Technical Working Area 7

BIOENGINEERING MATERIALS

Dr T Tateishi, Mechanical Engineering Laboratory
1-2 Namiki, Tsukuba-si, Ibaraki 305, Japan
Tel: +81 298 54 2509
Fax: +81 298 54 2549

Objectives

- To establish internationally agreed procedures for biocompatibility testing of bioengineering materials using cell culture methods

Dissemination

Three significant actions have now arisen from the work of the TWA.

- The international round robin tests of the TWA 7 in 1991 are to be published in Advances in Biomaterials, volume 10 (Elsevier).
- The results of the international round robin tests of the TWA 7 will be reported to the TC194/ISO through Dr Nakamura, a member of the TC194/ISO.
- Procedures for wear testing of biomaterials are about to be standardised in a Japan Industrial Standard (JIS), conforming with the previous recommendations by the VAMAS TWA 7.

Technical Working Area 8

HOT SALT CORROSION RESISTANCE

Dr T B Gibbons, Division of Materials Metrology
NPL, Teddington, Middlesex, UK, TW11 0LW
Tel: +44 81 943 6026
Fax: +44 81 943 2989

Objectives

- To develop unified procedures for assessing the hot salt corrosion resistance of superalloys in burner-rig tests

Dissemination

A guideline document produced on the basis of a survey of operating conditions of burner-rig facilities worldwide is being used to specify testing conditions for assessment of the performance of gas turbine alloys. An intercomparison activity is in progress to probe the validity of the document.

A special edition of the journal *High Temperature Technology* was produced in 1990 which described the state-of-the-art in hot salt corrosion testing.

The plan is to produce a revised guideline document as a 'Code of Practice' when the intercomparison exercise has been completed. This would be published in collaboration with a national standards body or professional society.

MATERIALS DATABANKS

Dr J H Westbrook, SCI-Tech Knowledge Systems, 133 Saratoga Road
NY 12302, USA
Mr H Kröckel, CEC JRC, Petten, ZG-1755, The Netherlands
Tel: +31 2 246 5208
Fax: +31 2 246 1002

Objectives

- To assess the role of standards in the flow of computerised materials information
- To identify needs, problem areas and options for standardisation activity and coordinate pre-standardisation research

Dissemination

The original mandate of TWA 10 was limited to a one-year activity to identify areas where standards and standards development would significantly impact on the development, building and operation of factual materials databanks. This phase was concluded by the production of a consensus report of the TWA 10 Task Group on 'The Need for Standards', VAMAS Technical Report No. 2. The report addressed sets of specific recommendations to more than 30 organisations, e.g. national and international standards bodies, CODATA etc.

Following the worldwide attention generated by this report for the materials databanks field and for the work of TWA 10, the mandate was extended to include the investigation of several specific standardisation aspects on which information was disseminated through 4 VAMAS Technical Reports, 2 International VAMAS Workshops, a number of publications in scientific/technical journals. Data sets and results of interlaboratory comparisons of computerised data evaluation methods have also been distributed in the form of PC disks.

Dissemination plans for two current activities producing VAMAS inventories of material designation systems, and methods for data analysis and evaluation, respectively include open publication in printed form and use of computer routes. Inventories of 'best' methods which have worldwide acceptance and quality confirmation based on interlaboratory comparisons should be of significant prenormative value. The transfer mechanisms of such inventories to standardisation will need to be developed.

Technical Working Area 11

CREEP CRACK GROWTH

Dr T B Gibbons, Division of Materials Metrology
NPL, Teddington, Middlesex, UK, TW11 0LW
Tel: +44 81 943 6026
Fax: +44 81 943 2989

Objectives

- To develop a unified approach to the measurement and interpretation of creep crack growth data

Dissemination

The draft standard on creep crack growth measurement, produced on the basis of the results of the VAMAS Project by the E24 Committee of ASTM has now completed the balloting procedure and is in the final stages of editing. The document is expected to be generally available in 1992 and will be a significant contribution to the demand for improved techniques for characterisation and measurement of materials properties for applications in power engineering, chemical plant etc. It is acknowledged that the collaborative nature of the VAMAS Project which brought together the key experts in the various centres of excellence on crack growth measurement in Europe, USA and Japan was essential in providing the necessary technical input to the development of the standard.

The members of the VAMAS Group have contributed to a special edition of the journal *Materials at High Temperature* on creep crack growth which is due to be published in mid 1992. The aim is to provide a reference volume describing the state-of-the-art in measurement, interpretation and usage of creep crack growth data. Papers describing the application of crack growth data to predict component lifetimes are a significant feature.

EFFICIENT TEST PROCEDURES FOR POLYMER PROPERTIES

R P Brown, Rapra Technology Ltd., Shawbury, UK, SY4 4NR.
Tel: +44 939 250383
Fax: +44 939 251118

Objectives

- To provide support for standardisation activities in the characterisation of long term properties of viscoelastic polymer materials
- To produce a guide for accelerated durability tests
- To consider the role of standard reference materials in accelerated durability testing

Dissemination

The specific work programme includes the development and publication of two guides:-

(i) General guide to the use of accelerated durability tests (ADT)

(ii) Guide to the use of standard reference materials (SRM) in ADT

These guides are intended to be submitted to ISO for consideration but TWA 12 also expects them to be published in advance of any ISO processing. This could be under the ISO/VAMAS Technology Trends banner.

A survey of the status of test methods for accelerated durability testing has been published in Polymer Testing Journal.

An interlaboratory trial on SRMs in weathering is due to start and it is expected that the results will be published in the technical press.

Technical Working Area 13

LOW CYCLE FATIGUE

Dr D Gould, CEC, rue de la Loi 200, B-1049 Bruxelles
Tel: + 32 2 235 9313
Fax: + 32 2 235 8072

Objectives

- To identify those aspects of testing procedure that significantly affect the reproducibility of the results of low cycle fatigue tests at high temperatures

Dissemination

A full technical report jointly produced by VAMAS and the CEC will be issued in the near future.

An important conclusion of the work of the TWA was to find that the most likely source of a great part of the interlaboratory uncertainties resulted from the effects of bending strains superimposed on the uniaxial strains. Consequently, further experiments are planned to systematically investigate the effects of bending/misalignment, strain measurement and temperature control methods using Nimonic 101 specimens made in a single laboratory.

It is anticipated that new guidelines will subsequently be written which will take into account appropriate bending tolerances and will specify limits for misalignment. A timescale of about 1.5 years is anticipated for this exercise.

Technical Working Area 14

THE TECHNICAL BASIS FOR A UNIFIED CLASSIFICATION SYSTEM FOR ADVANCED CERAMICS

S J Schneider, NIST, Gaithersburg, MD 20899, USA
Tel: +1 301 975 5657
Fax: +1 301 926 8349

Objectives

- To identify and assess issues inherent in the development of an internal classification system for advanced ceramics, particularly terminology and nomenclature.
- To establish a suitable classification structure and mechanisms for system implementation.

Dissemination

Transfer Mechanisms

The TWA project was initiated in 1988 to assure the transfer of pre-standards research to standards bodies and to facilitate the translation of the work into national and international standards. This objective is being accomplished through three interrelated ways. Firstly, the makeup of the membership of TWA 14 was formulated to have representation from members of all primary standard bodies and industry. Secondly, community awareness is maintained continually through a public forum process, including industrial surveys and workshops, and presentations at professional meetings. Thirdly, an interface activity will be undertaken directly with key standard committees, to introduce, explain and facilitate adoption of the TWA 14 developed classification Transfer Mechanisms.

Transfer Milestones

- International Survey on Classification of Advanced Ceramics: Report published by VAMAS (No. 5, ISSN 1016-2186, May 1991); Distributed worldwide to 120 industrial companies.
- Classification Workshop held June 1990: Proceedings in press.
- US (ASTM/ISR)-EEC(CEN)-Japan Sponsored Project implemented: Final matrix model classification system developed; Report due December 1992.
- Classification Standard Guide delivered to Standards Bodies: January - December 1993.

VAMAS Calendar

VAMAS Steering Committee Meeting Berlin, Germany	4 -5 June 1992
TWA 3 Meeting JRC, Petten, The Netherlands	2-4 September 1992
QSA-7 University of Surrey, Guildford, UK	7-11 September 1992
TWA 14 Meeting JRC, Petten, The Netherlands	September 1992
TWA 14 Meeting Berlin, Germany	10-11 December 1992

VAMAS Organisation

UNITED KINGDOM

CHAIRMAN

Dr Kamal Hossain
Head
Division of Materials Metrology
National Physical Laboratory
Teddington
Middlesex TW11 0LW
Tel: +44 81 943 6024

SECRETARY

Dr Bryan Roebuck
Division of Materials Metrology
National Physical Laboratory
Teddington
Middlesex TW11 0LW
Tel: +44 81 943 6298

Mrs Meg Langton
Technical Director
BSI
2 Park Street
London, W1A 2BS
Tel: +44 71 629 9000

Dr Tom Gibbons
Division of Materials Metrology
National Physical Laboratory
Teddington
Middlesex TW11 0LW
Tel: +44 81 943 6026

CANADA

Dr Jacques Martel
Director
Industrial Materials Research Institute
75, boulevard de Mortagne
Boucherville, Québec J4B 6Y4
Tel: +1 514 641 2280

FRANCE

Prof Claude Bathias
Conservatoire Nationale des Arts et Métiers
Department of Materials Engineering
292 rue St-Martin
75141 Paris CEDEX 03
Tel: +33 1 40272322

GERMANY

Prof Dr Horst Czichos
Vizepräsident
Bundesanstalt für Materialforschung und -prüfung
Unter den Eichen 87
D-1000 Berlin 45
Tel: +49 30 8104 0020

Dr Ing G Sievers
Regierungsdirektor
Bundesministerium für Forschung und Technologie
Heinemannstrasse 2
D-5300 Bonn 2
Tel: +49 228 59 555

ITALY

Dr Anna Gandini
ENEA
Viale Regina Margherita 125
Roma
Tel: +39 6 85 28 24 89

Prof Ing Paolo Giusti
Università di Pisa
Via Diotisalvi 2
56100 Pisa
Tel: +39 50 511 111

Prof Sergio lo Russo
Università di Padova
Via Marzolo U8
35131 Padova
Tel: +39 49 844 312

JAPAN

Mr Yuichi Maezawa
Director, OMST
Science and Technology Agency
2-2-1 Kasumigaseki
Chiyoda-ku
Tokyo-100
Tel: +81 3 3508 4097

Mr Mikio Hattori
Director, Materials Standards
MITI
1-3-1 Kasumigaseki
Chiyoda-ku
Tokyo-100
Tel: +81 3 3501 1511

Dr Atsushi Oguchi
Deputy Director General
NRIM
3-12, 2-Chome, Nakameguro
Meguro-ku
Tokyo-153
Tel: +81 3 3719 2271

USA

Dr Harry L Rook
Assistant Director
The Materials Science and Engineering Laboratory
National Institute of Standards and Technology
Building 223, Room B309
Gaithersburg MD 20899
Tel: +1 301 975 5658

Mr Joseph G O'Grady
Executive Director
Institute of Standards Research
American Society for Testing and Materials
1916 Race Street
Philadelphia PA 19103
Tel: +1 215 299 5555

CEC

Dr Ernest D Hondros, FRS
Director
CEC Joint Research Centre,
Petten, Postbus 2
ZG-1755 Petten
The Netherlands
Tel: +31 2 246 5401

Dr A Garcia-Arroyo
Director DG XII C
Commission of the European Communities
Directorate General XII
rue de la Loi 200
B-1049 Bruxelles
Belgium
Tel: +32 2 235 11 11

Printed in the UK by The Columbian Press May 92
National Physical Laboratory, Teddington, Middlesex