INTERNATIONAL UNION OF
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ANALYTICAL CHEMISTRY DIVISION
COMMISSION ON ANALYTICAL NOMENCLATURE

RECOMMENDATIONS FOR NOMENCLATURE OF THERMAL ANALYSIS

RULES APPROVED 1973

LONDON
BUTTERWORTHS

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Introduction

The rapid expansion of activity in the area of analysis by study of thermal phenomena renders it highly desirable to achieve some standardization of nomenclature in this topic. In considering this problem, the Nomenclature Commission became aware of the work of the Nomenclature Committee of The International Confederation for Thermal Analysis and studied the recommendations of this committee, made public over the name of its Chairman, Dr R. C. Mackenzie, in *Talanta*, **16**, 1227 (1969).

Following due consideration at its meetings the present Commission wholeheartedly endorses the recommendations made by the ICTA.

1. GENERAL RECOMMENDATIONS

(*a*) Thermal analysis and not 'thermography' should be the accepted name in English, since the latter has at least two other meanings in this language, the major one being medical [*Sci. Progr. London*, **55**, 167 (1967)]. The adjective should then be thermoanalytical (cf. physical chemistry and physicochemical): the term 'thermoanalysis' is not supported (on the same logical basis).

(*b*) Differential should be the adjectival form of difference; derivative should be used for the first derivative (mathematical) of any curve.

(*c*) The term 'analysis' should be avoided as far as possible since the methods considered do not comprise analysis as generally understood chemically: terms such as differential thermal analysis are too widely accepted, however, to be changed.

(*d*) The term curve is preferred to 'thermogram' for the following reasons:

(i) 'Thermogram' is used for the results obtained by the medical technique of thermography—see (*a*).

(ii) If applied to certain curves (e.g. thermogravimetric curves), 'thermogram' would not be consistent with the dictionary definition.

(iii) For clarity there would have to be frequent use of terms such as differential thermogram, thermogravimetric thermogram, etc. which are not only cumbersome but also confusing.

(*e*) In multiple techniques, *simultaneous* should be used for the application of two or more techniques to the same sample at the same time: *combined* would then indicate the use of separate samples for each technique.

(*f*) *Thermal decomposition* and similar terms are being further considered by the Committee.

2. TERMINOLOGY

Acceptable names and abbreviations, together with names which were for various reasons rejected, are listed in *Table 1*. The Committee are in

Table 1. Recommended terminology

Acceptable name	Acceptable abbreviation*	Rejected name(s)
A. *General*		
Thermal analysis		Thermography Thermoanalysis
B. *Methods associated with weight change*		
1. *Static*		
Isobaric weight-change determination		
Isothermal weight-change determination		Isothermal thermogravimetric analysis
2. *Dynamic*		
Thermogravimetry	TG	Thermogravimetric analysis Dynamic thermogravimetric analysis
Derivative thermogravimetry	DTG	Differential thermogravimetry Differential thermogravimetric analysis Derivative thermogravimetric analysis
C. *Methods associated with energy change*		
Heating curves†		Thermal analysis
Heating-rate curves†		Derivative thermal analysis
Inverse heating-rate curves†		
Differential thermal analysis	DTA	Dynamic differential calorimetry
Derivative differential thermal analysis		
Differential scanning calorimetry	DSC	
D. *Methods associated with evolved volatiles*		
Evolved gas detection	EGD	Effluent gas detection
Evolved gas analysis‡	EGA	Effluent gas analysis Thermovaporimetric analysis
E. *Methods associated with dimensional change*		
Dilatometry		
Derivative dilatometry		
Differential dilatometry		
F. *Multiple techniques*		
Simultaneous TG and DTA, etc.		DATA (Differential and thermogravimetric analysis) Derivatography Derivatographic analysis

* Abbreviations should be in capital letters without full stops, and should be kept to the minimum to avoid confusion.

† When determinations are performed during the cooling cycle these become *Cooling curves*, *Cooling-rate curves* and *Inverse cooling-rate curves*, respectively.

‡ The method of analysis should be clearly stated and abbreviations such as MTA (mass-spectrometric thermal analysis) and MDTA (mass spectrometry and differential thermal analysis) avoided.

accord with the suggestion, made during discussion of the report, that the limited number of abbreviations considered permissible should be adopted internationally, irrespective of language.

The Committee do not wish to pronounce on nomenclature in borderline techniques (such as thermometric titrimetry or calorimetry) which are, to its knowledge, being considered by other bodies. Consideration of techniques not yet extensively employed has been deferred.

3. DEFINITIONS AND CONVENTIONS

A. General

Thermal analysis. A general term covering a group of related techniques whereby the dependence of the parameters of any physical property of a substance on temperature is measured.

B. Methods associated with weight change

1. Static

Isobaric weight-change determination. A technique of obtaining a record of the equilibrium weight of a substance as a function of temperature (T) at a constant partial pressure of the volatile product or products.

The record is the isobaric weight-change curve; it is normal to plot weight on the ordinate with weight decreasing downwards and T on the abscissa increasing from left to right.

Isothermal weight-change determination. A technique of obtaining a record of the dependence of the weight of a substance on time (t) at constant temperature.

The record is the isothermal weight-change curve; it is normal to plot weight on the ordinate with weight decreasing downwards and t on the abscissa increasing from left to right.

2. Dynamic

Thermogravimetry (TG). A technique whereby the weight of a substance, in an environment heated or cooled at a controlled rate, is recorded as a function of time or temperature.

The record is the thermogravimetric or TG curve; the weight should be plotted on the ordinate with weight decreasing downwards and t or T on the abscissa increasing from left to right.

Derivative thermogravimetry (DTG). A technique yielding the first derivative of the thermogravimetric curve with respect to either time or temperature.

The curve is the derivative thermogravimetric or DTG curve; the derivative should be plotted on the ordinate with weight losses downwards and t or T on the abscissa increasing from left to right.

C. Methods associated with energy change

Heating curves. These are records of the temperature of a substance against time, in an environment heated at a controlled rate.

T should be plotted on the ordinate increasing upwards and t on the abscissa increasing from left to right.

Heating-rate curves. These are records of the first derivative of the heating curve with respect to time (i.e. dT/dt) plotted against time or temperature.

The function dT/dt should be plotted on the ordinate and t or T on the abscissa increasing from left to right.

Inverse heating-rate curves. These are records of the first derivative of the heating curve with respect to temperature (i.e. dt/dT) plotted against either time or temperature.

The function dt/dT should be plotted on the ordinate and t or T on the abscissa increasing from left to right.

Differential thermal analysis (DTA). A technique of recording the difference in temperature between a substance and a reference material against either time or temperature as the two specimens are subjected to identical temperature regimes in an environment heated or cooled at a controlled rate.

The record is the differential thermal or DTA curve; the temperature difference (ΔT) should be plotted on the ordinate with endothermic reactions downwards and t or T on the abscissa increasing from left to right.

Derivative differential thermal analysis. A technique yielding the first derivative of the differential thermal curve with respect to either time or temperature.

The record is the derivative differential thermal or derivative DTA curve; the derivative should be plotted on the ordinate and t or T on the abscissa increasing from left to right.

Differential scanning calorimetry (DSC). A technique of recording the energy necessary to establish zero temperature difference between a substance and a reference material against either time or temperature as the two specimens are subjected to identical temperature regimes in an environment heated or cooled at a controlled rate.

The record is the DSC curve; it represents the amount of heat applied per unit time as ordinate against either t or T as abscissa.

D. Methods associated with evolved volatiles

Evolved gas detection (EGD). This term covers any technique of detecting whether or not a volatile product is formed during thermal analysis.

Evolved gas analysis (EGA). A technique of determining the nature and/or amount of volatile product or products formed during thermal analysis.

E. Methods associated with dimensional change

Dilatometry. A technique whereby changes in dimension(s) of a substance are measured as a function of temperature.

The record is the dilatometric curve.

Derivative dilatometry; differential dilatometry. These terms carry the connotations given in 1(b) above.

F. Multiple techniques

This term covers simultaneous DTA and TG, etc. and definitions follow from the above.