SEMINAR ON THESAURUS (1975). Paper CH

INDEXING VOCABULARIES IN GLASS TECHNOLOGY AND NEED FOR AN INFORMATION RETRIEVAL THESAURUS - A PILOT STUDY

A K ROY,
Library Officer, Central Glass and Ceramic Research Institute, Calcutta

The indexing languages covering the subject field of glass technology in depth have been briefly surveyed to study their suitability for deep subject indexing of micro documents in the field. The need for an information retrieval thesaurus covering the subject has been stressed. Development of a thesaurus on glass fibres and glass fibre reinforced plastics, has been attempted, and a part of the thesaurus has been incorporated in the paper with a descriptive introduction about the principles and design methodology adopted.

0 INTRODUCTION

01 Glass as a Versatile Material in Modern Technology

The versatility of glass as a modern material in this space age has been due to its unique properties, as it can be tailor-made with almost any combination of its structural, mechanical, thermal, electrical, optical, and chemical properties. Therefore, the application of glass in science and engineering industry and architecture, communications and transportation, materials handling and sporting goods, aerospace and military market has proved almost limitless.

02 Influx of literature on glass technology

As a result of the tremendous interest in glass in the field of materials science, literature on glass technology is proliferating at a fast rate due to brisk research and developmental activities in the field all around the globe. Since information embedded in documents is an essential and important commodity to all R & D personnel in their intellectual persuit, special libraries and information centres should either look for the best available indexing language, or develop one by their own initiative, to fulfil the specialized discipline-oriented need for effective organisation of the information system to the maximum advantage of its users.

03 Scope of the paper

The objective of the work reported in this paper is to undertake a brief survey of the existing indexing languages, covering at depth the subject field of glass technology to evaluate the need for the development of an information retrieval thesaurus in the field. Development of a thesaurus has also been attempted in a very restricted scale on a narrow sub-division of glass technology i.e. 'glass fibres' and also covering its application as "glass fibre reinforced plastics'. A part of this thesaurus has also been incorporated in this paper with a descriptive introduction on the principles and methodology of its design and development.

04 Terminology

041 Indexing language

An indexing language is a system for naming subjects for indexing, and like any other language, should consist of two parts - vocabulary and syntax. The vocabulary is the list of terms that are included within the system. The syntax is the relationship that is demonstrated between the terms in the indexvocabulary.

042 Information retrieval thesaurus

An information retrieval thesaurus is a controlled but dynamic inde:* vocabulary with the display of unit concept terms. Terms are alphabetically arranged as 'word blocks', giving a systematic presentation of various levels of relationship of each term to the other terms in the index vocabulary. It is designed to assist the information system user to state his information needs in terms of the descriptor language used by the indexer at the input stage, so as to achieve perfect matching of query terms with index terms at the retrieval stage.

I SURVEY OF THE EXISTING LANGUAGES COVERING GLASS TECHNOLOGY

In the conventional as well as non-conventional systems, there exists primarily three kinds of controlled indexing vocabularies, e. g.

a) Classification schemes
b) Subject heading lists
c) Thesauri

II Classification schemes

Although many classification schemes cover glass technology within the scope of a broader subject area, no depth schedules have, however, been provided by them, except in the cases of the following three schemes.

a) Universal Decimal Classification (UDC). Depth schedule on glass ar. ceramics. B S 1000(666):1971. (1)

b) Documentation Europeene Ceramique (D E C). (2) and (3)

c) Colon Classification. Provisional depth schedule on glass production technology. (4)

A brief survey of these three schemes has been attempted to study their suitability as indexing languages for deep subject indexing of macro - as well as micro-documents covering the few important areas of modern research and developmental interest in the field of glass technology, e.g. glass-ceramic {devitrified glass), laser glasses, optical glass, fibre optics, glass fibres, etc. The scope of the study has been restricted to the following criteria.

a) Coverage of current topics of R t D interest and terminological problems
b) Depth of coverage of the topics
c) Type of alphabetical subject index provided with the depth schedules

1 2 Universal Decimal Classification {U D C) Depth schedule on glass and ceramics

121 Coverage of current topics of R & D interest and terminological problems

a) Glass- ceramic (devitrified glass)

Although glass-ceramic was first developed in the year 1957 and since then it has occupied a place of prime importance as a material which can withstand ever-higher speeds and temperatures and have applications in aerospace and other fields, UDC scheme has not given adequate coverage to this special type of glass. The literature on the subject has grown rapidly and more than twelve hundred documents have been recorded in the bibliography compiled on the subject by the Central Glass and Ceramic Research Institute, Calcutta. {5)

The topic has been referred in three places in the depth schedule, e. g.

666.1.038 ANNEALING. REHEATING. STRIKING. 8 Devitrification processes (induced processes only)

666. 11. 019 GLASS DEFECTS
. 24 Changes in structure
. 241 Due to crystallization or devitrification

666. 263 OPAQUE GLASS
. 2 Opacification by devitrification.

From the illustrations given, it is clear that the concept of 'glass-ceramic' as an important type of glass and its sub-divisions e. g. slag glass-ceramic, pyroxene glass-ceramic, photosensitive glass-ceramie, etc. and its applications in various spheres of science and technology have found no place in the depth schedule published even as late as 1971. The synonym control, e, g. pyroceram (R), devitrified glass, ceramised glass, Bit all, pyrosil (R), etc., referring to glass-ceramic, cannot be found either in the schedule or in the alphabetical subject index.

b) Laser glasses

The principles of laser (light amplification by stimulated emission of radiation) technique is used to amplify the optical energy. Principal applications for this device include space communications and very high resolution radar, and other chemical, medical, and biological uses. Glass has become an important host for laser action.

The concept of 'laser glasses' as a glass type has not been given any coverage in the U D C depth schedule for glass and ceramics.

c) Fibre optics

The field of fibre optics concerns itself with the guidance of light by multi-

pie reflections along channels formed from glass or plastic. The fundamental unit in any fibre optics system is the individual optical fibre, which is basically a cylinder of transparent dielectric material surrounded by a second dielectric. The technique of fibre optics has its applications in the provision of illumination for medical instruments and the sensing of holes in punched-card readers when it is used as non-coherent bundles. In the coherent area, the flexible bundle has found its main application in medical inspection, whilst the solid bundle has been used almost exclusively as a faceplate in electron optical image tubes.

The isolate idea of 'optical fibre' or 'fibre optics' has also not been included in the treatment of the basic subject glass technology in U D C 666.

d) Optical glass

Glass of high quality having closely specified optical properties, used in the manufacture of optical systems.

The types of optical glass have been enumerated in the U D C 666 in the following manner.

666.22 OPTICAL GLASSES
666. 221 General. Types
. 3 Crown glass
, 4 Flint glass
.6 Special glasses

However, in the depth schedule on glass and ceramics, it is quite logical to expect further subdivisions of the two important types of optical glasses, i.e. 'crown glass' and 'flint glass'. The following thesaurus type display of the same may appear to the indexer as more helpful than the coverage given in the U D C 666

OPTICAL GLASS

NT 1. CROWN GLASS
NT 2. BARIUM FLINT GLASS
NT 2. BOROSILICATE CROWN GLASS
NT 2. CROWN FLINT GLASS
NT 2. DENSE BARIUM CROWN GLASS
NT 2. EXTRA DENSE BARIUM CROWN GLASS
NT 2. FLUCOR CROWN GLASS
NT 2. LANTHANUM CROWN GLASS
NT 2. LANTHANUM FLINT GLASS
NT 2. LIGHT BARIUM CROWN GLASS

NT 1. FLINT GLASS
NT 2. DENSE FLINT GLASS
NT 2. EXTRA DENSE FLINT GLASS
NT 2. EXTRA LIGHT FLINT GLASS
NT 2. LIGHT FLINT GLASS
NT 2. TELESCOPE FLINT GLASS

NT 1 = Narrower term of the array of order *1*
NT 2 = Narrower term of the array of order 2

e) Glass fibres

This is the generic term for glass that has been attenuated into fibres, A continuous glass fibre (continuous s;lass filament) is known as 'glass silk' ; 'staple fibres' are glass fibres of relatively short length, whereas fleecy mass of plain glass fibres is known as 'glass wool'. The unique properties and various forms of glass fibres plus the variety of plastic materials available today give rise to a broad spectrum of glass-resin combinations which has multifarious applications in science and industry.

The isolate idea 'glass fibres' has been treated in U D C 666 in the following manner.

666.189.2 SPUN GLASS. GLASS FILAMENTS GLASS WOOL, GLASS MATTING AND OBJECTS MADE FROM THEM.
. 21 Glass filaments
. 211 Glass fibres. Staple fibres (finite filaments)
212 Glass silk (infinite filaments)
. 22 Glass wool. Glass matting
. 23 Glass fibre yarn. Glass fibre roving

The above example is a pointer towards terminological anomaly and incorrect building of hierarchy. Both B. S. 3447:1 962 (6) and K.L. Loewenstein (7) have made it clear that glass fibres' is the correct generic term for

all types of fibres attenuated from molten glass, and as such, glass silk, staple fibres and glass wool should have been shown as immediate subordinate classes of 'glass fibres'. Moreover, terminological anomaly has cropped in due to the use of the term 'glass filaments' as the generic term for subdivision of glass fibres, staple fibres etc. Glass filament is 'a glass fibre as drawn' (B. S. 3447: 1962). Further, 'glass wool[1] has been shown as coordinate class of 'glass filaments', the generic term used by U D C for 'glass fibres'. 'TEST' has also shown 'glass wool' as a narrower term of 'glass fibres' (8). The proper hierarchy with the control of terminology can be shown in the following thesaurus type display, which can be of great assistance both for the indexer as well as the searcher, if used as an indexing language in place of the classification schedule.

GLASS FIBRES

UF FIBRE GLASS
UF GLASS FILAMENTS
UF SPUN GLASS

NT 1 GLASS SILK
NT 2 ROVINGS
NT 2 STRANDS
NT 2 YARN

NT 1 GLASS WOOL
NT 2 GLASS WOOL MATS

NT 1 STAPLE FIBRES
NT 2 STAPLE TEXTILE FIBRES
NT 3 SLIVER

BT 1 FIBRES
BT 2 INORGANIC MANMADE FIBRES
BT 1 GLASS

RT CERAMIC FIBRES
RT HIGH SILICA FIBRES
ST QUARTZ FIBRES

UF = Used for
NT1 = Narrower term of the array of order 1
NT2 = Narrower term of the array of order 2
NT3 = Narrower term of the array of order 3
BT1 = Broader term of the array of order 1
BT2 = Broader term of the array of order 2
RT = Related term

122 Depth of coverage of the topics

In relation to the coverage of glass & ceramic technology in B. S. 1000A:1961 - abridged English edition of U D C, the present depth schedule B. S. 1000(666): 1971 has treated the subject field at a far more greater depth which has appeared as a welcome relief to the U D C. users in this field. However, certain topics of modern R & D interest should have been either incorporated, or covered at a greater depth, which is evident from the discussion and examples cited in the preceding section 1111(a) to (e).

123 Type of alphabetical index

The alphabetical index to U D C 666 was not designed with a systematic policy and does not appear to be a very helpful tool either for entry into the vocabulary used in the schedule, or for control of terminology by helpful cross-references. The following examples may, however, clarify the statement to certain extent.

a) Schedule terms 'glass filaments' and 'glass silk' have not been entered in the index, except in their inverted form as 'filament-glass', and 'silk-glass'. This may create confusion about the correct form of heading to be chosen for indexing.

b) All the terms used in the schedule have also not been included in the index, not even in their inverted form as referred to in (a) above, e, g.

666. 247. 3 Heat absorbing glasses
666. 11. 01 : 539:213:22 Relaxation temperatures

There are no entries in the index under any of the following headings.

Glasses - heat absorbing
Heat absorbing glasses
Relaxation temperatures
Temperatures - relaxation.

13 Documentation Europeane Ceramique (D E C)

The original French edition of the DEC classification code (2), with its alphabetical index (3) was examined for this study.

131 Coverage of certain current topics of R & D interest and terminological problems

a) Glass-ceramic

The coverage of this topic has been

given in the schedule in the following manner, without any further sub-division of the concept.

V 38 Verres speciaux (special glasses)
V 381 Verres photosensibles (photosensitive glasses)
V 382 Verres type Pyrocerame (pyroceram type glasses)

'Pyroceram' is the registered trade name of Corning Glass Works, USA for [1] glass-ceramie'. Many other synonyms of this concept has already been mentioned in section 1111 (a). While the process is termed as devitrification of glass, the commonly used term in the literature for the product is 'glass-ceramic'. However, 'TEST' (8) has preferred to use 'devitrified glass' as the descriptor term. The use of the synthesised term 'devitrified glass-ceramic' can also be found in certain British and Japanese patents.

b) Laser glasses and

c) Fibre optics

These two topics are conspicuous by their absence in the DEC Code.

d) Optical glass

The topic has been shown as a 'type of glass', without any further enumeration of its sub-divisions, e. g.

V 34 Verre creux (container glass)
V 35 Verre d'optique (optical glass)
V 36 Verre colores (coloured glass)

e) Glass fibres

The treatment of this topic in DEC immediately follows the class V 38 which has been outlined in (a) above.

V 38 Verres speciaux (special glasses)
V 39 Fibres de verre (glass fibres)
V 41 Billes de verre (glass beads)

No further enumeration of the sub-divisions of 'glass-fibres' has been shown under V 39- A thesaurus display of this topic has been given in section 1111 (e) showing the sub-divisions and proper hierarchy.

1 32 Depth of coverage

While the scheme was primarily designed as a depth schedule on glass, ceramics and refractories, as a special classification code it also attempted to cover the other areas of science and technology which have interactions with the preferred subjects. As a result, many important basic subjects were bundled up within the scope of only one main class, e. g. general problems, mathematics, chemistry, physical chemistry, mineralogy, petrography, geology, physics, management, and general economic questions - all have been shown as sub-divisions of the main class 'A'. While general classification schemes like U D C, C C etc. can generate special depth schedules on any subject with equal emphasis, DEC being a subject specialised scheme is, in that respect, in a disadvantageous position. Moreover, in absence of any organised revision policy, no further fully revised edition was brought out after the publication of the first draft edition in 1961. As a result, DEC users were left with no other option but to develop the vocabulary as well as the structure of the scheme to suit the needs of their own organisations, with obvious risks of non-conformity among themselves.

133 Type of alphabetical index

The alphabetical index is naturally restricted to the vocabularies used in the schedule part, where most of the topics of current R & D interest were not dealt in details, as already discussed in the section 1121(a) to (e). Scope notes were, provided within parenthesis to limit the meaning of certain concepts. Generic terms, whose subdivisions were not given coverage in the index, were underlined as a guide to refer to the schedule for more narrower concepts.

14 Colon classification - glass production technology : Depth schedule

A provisional schedule for the depth classification of subjects going with the Host Subject 'Glass Production Technology' was devised and published by Neelamegan in 1967 (4). The depth schedule is supplemented by a detailed alphabetical subject index. While Colon Classification is a freely faceted scheme with the provisions for single concepts and **the** mechanism so that the indexer can construct headings for composite subjects, only about fifty percent of the isolates have been enumerated in this schedule.

141 Coverage of current topics of R & D interest and terminological problems

a) Glass-ceramic

The concept has been displayed in the

given in the schedule in the following manner, without any further sub-division of the concept.

V 38 Verres speciaux {special glasses)
V 381 Verres photosensibles {photosensitive glasses)
V 332 Verres type Pyrocerame (pyroceram type glasses)

'Pyroceram' is the registered trade name of Corning Glass Works, U S A for 'glass-ceramic'. Many other synonyms of this concept has already been mentioned in section 1111(a). While the process is termed as devitrification of glass, the commonly used term in the literature for the product is 'glass-ceramic'. However, 'TEST' (8) has preferred to use 'devitrified glass' as the descriptor term. The use of the synthesised term 'devitrified glass-ceramic' can also be found in certain British and Japanese patents.

b) Laser glasses and

c) Fibre optics

These two topics are conspicuous by their absence in the D E C Code.

d) Optical glass

The topic has been shown as a 'type of glass', without any further enumeration of its sub-divisions, e. g.

V 34 Verre creux (container glass)
V 35 Verre d'optique (optical glass)
V 36 Verre colores (coloured glass)

e) Glass fibres

The treatment of this topic in D E C immediately follows the class V 38 which has been outlined in (a) above.

V 38 Verres speciaux (special glasses)
V 39 Fibres de verre (glass fibres)
V 41 Billes de verre (glass beads)

No further enumeration of the sub-divisions of 'glass-fibres' has been shown under V 39. A thesaurus display of this topic has been given in section 1111(e) showing the sub-divisions and proper hierarchy.

132 Depth of coverage

While the scheme was primarily designed as a depth schedule on glass, ceramics and refractories, as a special classification code it also attempted to cover the other areas of science and technology which have interactions with the preferred subjects. As a result, many important basic subjects were bundled up within the scope of only one main class, e. g. general problems, mathematics, chemistry, physical chemistry, mineralogy, petrography, geology, physics, management, and general economic questions - all have been shown as sub-divisions of the main class 'A'. While general classification schemes like U D C, C C etc. can generate special depth schedules on any subject with equal emphasis, D E C being a subject specialised scheme is, in that respect, in a disadvantageous position. Moreover, in absence of any organised revision policy, no further fully revised e.dition was brought out after the publication of the first draft edition in I96I. As a result, D E C users were left with no other option hut to develop the vocabulary as well as the structure of the scheme to suit the needs of their own organisations, with obvious risks of non-conformity among themselves.

133 Type of alphabetical index

The alphabetical index is naturally restricted to the vocabularies used in the schedule part, where most of the topics of current H & D interest were not dealt in details, as already discussed in the section 1121 (a) to (e). Scope notes were, provided within parenthesis to limit the meaning of certain concepts. Generic terms, whose subdivisions were not given coverage in the index, were underlined as a guide to refer to the schedule for more narrower concepts.

14 Colon classification - glass production technology : Depth schedule

A provisional schedule for the depth classification of subjects going with the Host Subject 'Glass Production Technology' was devised and published by Neelamegan in 1967 (4). The depth schedule is supplemented by a detailed alphabetical subject index. While Colon Classification is a freely faceted scheme with the provisions for single concepts and the mechanism so that the indexer can construct headings for composite subjects, only about fifty percent of the isolates have been enumerated in this schedule.

1 41 Coverage of current topics of R & D interest and terminological problems

a) Glass-ceramic

The concept has been displayed in the

schedule under glass types, e.g.

9b Silicate glass
9k Lindeman glass
9m Non-silicate glass
9x Glass-ceramic

while 'silicate glass' and 'non-silicate glass' were shown with their sub-divisions by telescoping device, 'glass-ceramic' was not further subdivided. It may be quite pertinent to note that the appropriate term as per literary warrant, i. e. 'glass-ceramie' has been used, in place of 'devitrified glass' as preferred by TEST (8).

b) Laser glasses and

c) Fibre optics

Although both U D C 666 and D E C failed to give any coverage to these very important fields of research in glass physics, the provisional depth schedule of C C has covered both these concepts, e.g.

T BY SPECIAL-RADIATION-PROPERTY-BASED USE
T5 Glass laser
T6 Laser beam reflector
T7 Fibre optics

However, no further subdivisions of these concepts were shown directly under the terms. The importance of fibre optics has already been stressed in section 1111(c). A thesaurus type display of this topic is given below to show the current terminologies associated with this concept, with their mutual relationship.

FIBRE BUNDLE

NT ALIGNED BUNDLE
FUSED BUNDLE
NON-ALIGNED BUNDLE

BT FIBRE OPTICS

RT BOULE

FIBRE OPTICS

NT BOULE
COATING (OPTICAL FIBRE)
CORE (OPTICAL FIBRE)
FIBRE BUNDLE
IMAGE CONDUITS
IMAGE DISSECTOR
IMAGE INVERTER
INFRARED FIBRE OPTICS
LASING FIBRES
LIGHT FUNNEL
LIGHT GUIDE

OPTICAL FIBRE

ULTRAVIOLET FIBRE OPTICS

BT OPTICS

RT ENDOSCOPY
FIELD FLATTENER
FLEXIBLE FIBRESCOPE
FOCON
FRUSTRATED TOTAL REFLECTION
GLASS FIBRES
GLASS COATED GLASS FIBRE

USE OPTICAL FIBRE

- IRFO
USE INFRARED FIBRE OPTICS

OPTICAL FIBRE

NT ACTIVE FIBRES
CONICAL FIBRES
LASING FIBRES
MULTIPLE FIBRES
PASSIVE FIBRES
SCIENTILLATING FIBRES

BT FIBRE OPTICS

NT = Narrower term BT = Broader term
RT = Related term

d) Optical glass

This concept has been treated in a different way, i. e. the terms 'optical glass', and its types e.g. 'flint glass' and 'crown glass' etc. has not been used in the schedule. Alternatively, this subdivision of glass has been derived 'by optical property'.

cR BY OPTICAL PROPERTY
cR3B By refractive index (at Sodium D line)
cR3C By birefringence Birefringent

and so on.

e) Glass fibres

This concept has been derived by subdivision of glass, first 'by purpose' and then further subdivision derived 'by non-fabricated form'.

9A BY PURPOSE
T(A2) into (Al) begins
By non-fabricated form
9W Fibre glass
9W1 Beta glass
9W3 Torsion
9W4 Discontinuous
9W7 Continuous

The application of glass, including that of glass fibres, has been shown as 'by fabricated form', and as such, applications of a particular type of glass has been scattered. In the above example, it may also be noticed that the term 'fibre glass' has been used in place of 'glass fibres' which is the most commonly used term in literature and glossaries. The concept is, however, termed in U S A as 'fibre glass'.

1 42 Depth of coverage

Quasi Isolates (QI) in (IP) and (2P) have been derived at great depth by blending the 'a priori' and 'pragmatic approaches'. The latter consisted in examining about 200 assorted micro documents and a few macro documents.

143 Type of alphabetical index

Helpfulness in locating concepts used in schedule has been increased to a great extent by rotation of individual terms in multiworded single concepts, e.g.

MR Thermocouple protection tube

Index entries

Protection tube of Thermocouple	MR
Thermocouple protection tube	MR
Tube Y7 Thermocouple protection	MR

However, this technique of rotation of terms in index entries has not been adopted uniformly, e. g. GR Mirror disc for reflecting telescope.

Index entries

Mirror	QC
disc	GR

There is, however, no index entries either aa 'Reflecting telescope-mirror disc' referring to the isolate number GR.

1 5 Subject heading lists

The most commonly used subject heading lists like 'Sears List of Subject Headings' and 'Subject Headings used in the Dictionary Catalogs of the Library of Congress' are too general in coverage and are thus found inappropriate for indexing of microdocuments of a specialised subject like glass technology.

16 Thesauri

No thesauri, exclusively covering the subject fields of glass and ceramic technology, has yet been compiled or deposited to the Bibliographic Systems Center, Cleveland, Ohio, which is Unesco's Clearing-House for thesauri.

NEED FOR AN INFORMATION RETRIEVEL THESAURUS IN GLASS TECHNOLOGY

21 Background

The result of the survey of the existing indexing languages on glass technology in section 1 clearly indicates that classification schemes and general subject heading lists etc. with more or less static vocabularies and broader coverage of current topics of R & D interest of the preferred subject field, cannot satisfactorily fulfil the requirement of an information system comprising primarily of microdocuments and non-book materials. In a practical situation like this, 'free-indexing' might appear as the only immediate solution, achieving some sorts of vocabulary control by 'see' references, and interconnection of related topics of adequate 'see also' references in the catalogue. However, this method can neither be efficient, due so alphabetical scattering of related topics and the difficulties of revealing the various types of relationship, nor economic, due to unhelpful growth in the size of the file by enormous cross reference entries. A dynamic thesaurus type indexing language, with its various ingenious recall-rand precision-oriented devices, might, however, appear as a real helpful solution to the problem of deep indexing and satisfactory retrieval.

22 Thesaurus approach to the systems design for indexing and retrieval

The purpose of an information retrieval thesaurus has already been defined in section 042. The thesaurus principle is based on the post-coordinate method of indexing, i. e. the input being unit concepts, which tend to he single terms, or multiworded where necessary, and the actual coordination of concepts being performed at the output or retrieval stage. The

principal differencea between classification schemes and conventional alphabetical subject heading lists, and the thesaurus are that while in a thesaurus only unit concept terms are used as descriptors or preferred headings, there has also been a considerable loosening of control in it about the display of relationships, i.e. in addition to hierarchical relationships shown as BT and NT, associative relationships at conceptual level are also displayed as PT. The idea seems to have been that it offers greater possibilities to the indexer to make redundant indexing, and also to the searcher for redundant searching. The degree of redundancy can, however, be intellectually and selectively applied according to the need of the specific situation.

23 The glass technology

As already stated in section 115, no comprehensive thesaurus has yet been comnjiled in the field of glass technology, although many discipline-oriented thesauri, like 'INIS Thesaurus' in the field of nuclear energy, 'Thesaurofacet' of the English Electric Co., 'BIM Thesaurus of Terms' of the British Institute of Management, etc. have been compiled long back.

231 Pesign methodology

From the available discipline oriented thesauri, it has been observed that in many cases the structure of the thesaurus has been developed based on an available faceted classification scheme or a classification scheme was specially constructed for the purpose. The following examples may elucidate this statement.

Thesaurus	Classification schem
Thesaurofacet (9) (English Electric Co. Whetstone)	A faceted classificatio for engineering
TEST [8) (Engineers Joint Council, New York)	COSATI Subject Category List
INSPEC Thesaurus (1 0) (Institution of Electrical Enginee rs, London)	Unified Classification Scheme, INSPEC
Computer-Generation of Thesaurus on Programming Language (11) (M.Shepherd and C. Watters)	Classification Scheme for the subject Programming Language.

Since the existing classification schemes on, and covering glass technology have been found inadequate for the purpose of generating a thesaurus on the subject, and compilation of a comprehensive thesaurus covering the whole field of glass technology will require huge resources, manpower and lot of man-hours, it is suggested that the work may be taken up piecemeal, i, e. on separate isolate ideas of the subject field of glass technology, e, g. glass fibres, glass-ceramic, laser glasses, fibre optics, optical glass etc. In the last stage of the work the individual thesaurus of terms may be merged, updated and finally edited to form a comprehensive thesaurus on glass technology. Ceramic technology including refractories may also be covered in the same manner. Accordingly, compilation of a thesaurus on glass fibres and glass fibre reinforced plastics has been attempted as a pilot study, given in sec 4 of this paper and a part of this thesaurus.

THESAURUS OF TERMS ON GLASS FIBRES AND GLASS FIBRE REINFORCED PLASTICS

81 Introduction

Dynamic research and development programmes in glass fibres and glass fibre reinforced plastics are leading to materials with extremely high structural strength and modulus-to-weight ratios. The importance of these modern materials in science and industry necessitates the compilation of a technical thesaurus on the subject for effective control of its information systems.

VI Main part of the thesaurus

The main part of the thesaurus is arranged in the alphabetical sequence of descriptors as 'word blocks'. Non-descriptors have also been included in the main part and distinguished by "—" sign before them. The following information are included in the main part.

Concept representations

Descriptors
Non-de scriptors
USED FOR reference

Additional information

Definitions
Scope notes

Concept relationships

Broader concepts - BT
Narrower concepts - NT
Related concepts (associative relations) - RT

33 Auxiliary parts of the thesaurus

In order to show the actual hierarchy of terms within the same group of concept relationship, and the descriptors of the same category, design of a category list has been planned which will be developed into a depth schedule later on. This part, however, has not been incorporated in the paper.

34 Alphabetical index

A permuted index of the compound descriptors has been planned and will be given in the completed thesaurus in future.

35 Collating sequence

The arrangement of descriptors and non-descriptor terms have been done letter-by-letter, e. g.

letter-by-letter (actual arrangement in the main part)	word-by-word (arrangement not adopted)
Fibre reinforced plastics	Fibre reinforced plastics
Fibres	Fibre size applicator
Fibre size applicator	Fibres

36 Selection of descriptors

Since 'gestalt method' of thesaurus construction is more generally applicable to broad subject fields involving several disciplines, the 'analytical method' was adopted for this pilot run in construction of thesaurus on glass fibres, i. e. subject content of the literature was surveyed and analysed for selection of terms from them. Both macro-and-microdocuments were surveyed for term collection. The collected terms were later verified and evaluated with the existing technical dictionaries and glossaries and also with the query terms used by the users of the information system.

37 Recording procedures

The terms were collected in standard slips and then grouped in broad categories for fixation of hierarchies and associative relations with the help of existing classification schemes and current literature.

J8 Methods of avoiding ambiguity

Brief explanatory scopenotes have been provided to clarify the meaning of certain descriptors in a given context. Short definitions have also been given in cases of ambiguous descriptors, e, g.

A - GLASS
A high alkali containing, and boron free, glass composition for glass fibres.

BT FIBRE MAKING GLASSES

391 Descriptor interrelationships

a) Equivalence relation

In cases of synonyms and quasisynonyms, USE reference have been employed and such lead-in terms have been distinguished by "—" sign, e. g.

-DECORATED GLASS FABRIC
USE GLASS CLOTH

Cross references have also been given about the lead-in terms under the descriptor terms by the use of "UF" reference, e. g.

GLASS CLOTH
UF DECORATED GLASS FABRIC
GLASS FABRIC
GLASS TEXTILES

b) Hierarchical relation

The generic terms of the descriptor have been shown by the use of the symbol BT, whereas the specific or subordinated terms have been shown as NT, e.g.

GLASS FIBRES
NT GLASS SILK
BT FIBRES
GLASS

c) Associative relation

Associative relation has been employed to cover the other relations between concepts that are related but are neither consistantly hierarchical nor equivalent, e. g.

GLASS FIBRES

RT ASBESTOS FIBRES
CERAMIC FIBRES
GLASS FIBRE REINFORCED PLASTICS.

392 Pilot Study

As a pilot run, this thesaurus with the display of various relationships among descriptor terms, is purely tentative and subject to further critical examination and study before it is finally established on a definitive basis. Moreover, while collecting terms, all categories of the subject were not covered categories not in their exhaustiveness, with a view to restrict the total number of terms within a manageable limit for establishment of various relationships among them. Suggestions received from information specialists and users of the system will be recorded in a central file for consideration of their final acceptance in the thesaurus after verification and evaluation.

THESAURUS OF TERMS ON GLASS FIBRES AND GLASS FIBRE REINFORCED PLASTICS

-ABS
USE ACRYLONITRILE BUTADIENE STRYRENE

ACETAL
BT THERMOPLASTIC MATERIALS

ACRYLIC
BT THERMOPLASTIC MATERIALS

ACRYLONITRILE BUTADIENE STRYRENE
UF ABS
RT THERMOPLASTIC MATERIALS

A - GLASS
A high alkali containing, and boron free, glass composition for glass fibres.
RT FIBRE MAKING GLASSES
RT C - GLASS
D - GLASS
E - GLASS
L - GLASS
M - GLASS
S - GLASS

AIR BLOWER
BT STAPLE TEXTILE FIBRE FORMING EQUIPMENT

ASBESTOS FIBRES
BT FIBRES
RT GLASS FIBRES

AUTOMATIC WINDER
BT WINDER

BAKING
BT GLASS CLOTH FORMING PROCESS

BASE PLATE
BT BUSHING

BASKET
BT BUSHING

BORON FIBRES
BT FIBRES
RT GLASS FIBRES

BUSHING.
A small furnace of platinum alloy used for converting glass into fibres.
NT BASE PLATE
BASKET
BUSHING FRAME
BUSHING TERMINALS
NOZZLE
NOZZLE SHIELD
BT GLASS SILK FORMING EQUIPMENT
STAPLE TEXTILE FIBRE FIBRE FORMING EQUIPMENT

- BUSHING EARS
USE BUSHING TERMINALS

BUSHING FRAME
- BT BUSHING

- BUSHING LUGS
USE BUSHING TERMINALS

BUSHING TERMINALS
UF BUSHING EARS
BUSHING LUGS
BT BUSHING

- BUTTERFLY
USE TRAVERSE

CAKE
Primary package of fibre strand in a collet.
BT GLASS SILK FORMING EQUIPMENT
RT COLLET
WINDER

CARBON FIBRES
BT FIBRES
RT GLASS FIBRES

CEMENT
RT COMPOSITE REINFORCING MATERIALS

CERAMIC FIBRES
BT FIBRES
RT GLASS FIBRES

C - GLASS
An alkali-horosilicate glass composition for glass fibres with mineral acid-resistant properties.
BT FIBRE MAKING GLASSES
RT A - GLASS
D - GLASS
E - GLASS
L - GLASS
M - GLASS
S - GLASS

CHLORINATED POLYETHER
BT THERMOPLASTIC MATERIALS

CHOPPED STRAND MAT
BT MATS

RT CHOPPED STRANDS
CONTINUOUS STRAND MAT
OVERLAY MAT
SURFACE MAT

CHOPPED STRANDS
BT STRANDS
RT CHOPPED STRAND MAT
MILLED FIBRES

COLLECTING DRUM
BT STAPLE TEXTILE FIBRE FORMING EQUIPMENT

COLLET
BT WINDER
RT CAKE

- COMB
USE GATHERING SHOE

COMPOSITE MATERIALS
UF COMPOSITES
REINFORCED MATERIALS
RT COMPOSITE REINFORCING MATERIALS
FIBRE REINFORCED PLASTICS
GLASS FIBRE REINFORCED PLASTICS

COMPOSITE REINFORCING MATERIALS
RT CEMENT
COMPOSITE MATERIALS
FIBRES
PLASTICS
RUBBER

- COMPOSITES
USE COMPOSITE MATERIALS

- CONTINUOUS GLASS FILAMENT
USE GLASS SILK

CONTINUOUS STRAND MAT
UF SWIRL MAT
BT MATS
RT CHOPPED STRAND MAT
OVERLAY MAT
SURFACE MAT

CORONIZING
Aprocess of firing glass cloth, developed by Owens-Corning Fiberglass Corporation, USA, which provides permanent, no-iron features to the cloth.
BT GLASS CLOTH FORMING PROCESS

- COUPLING AGENT
USE KEYING AGENT

- DECORATED GLASS FABRIC
USE GLASS CLOTH

- DEEGLASS(R)
Tradename for glass fibres of Deeglass (B T R Industries), UK.
USE GLASS FIBRES

DESIGNING
Decoration of glass cloth during forming process.
BT GLASS CLOTH FORMING PROCESS

D - GLASS
A special glass fibre composition with improved dielectric property for high performance electronic applications and radome construction.
BT FIBRE MAKING GLASSES
RT A GLASS
C - GLASS
E - GLASS
L - GLASS
M - GLASS
S - GLASS

- DURAGLAS(R)
Tradename for glass fibre of Turner Brothers Asbestos Co. Ltd., UK.
USE GLASS FIBRES

- DURAMAT(R)
Tradename for glass fibres of Turner Brothers Asbestos Co. Ltd., U K.
USE GLASS FIBRES

E - GLASS
A high lime borosilicate glass composition for glass fibres, with a low alkali content, suitable for electrical insulation.
BT FIBRE MAKING GLASSES
RT A - GLASS
C - GLASS
D - GLASS
L - GLASS
M - GLASS
S - GLASS

- EIRENGLASS(R)
Tradename of Mica & Micanite Suppliers Ltd., U K for glass fibres.
USE GLASS FIBRES

EPOXY RESINS
BT THERMOSET MATERIALS
RT PHENOLIC RESINS
POLYESTER RESINS

- FAMCO(R)
Tradename of Cornelius Chemical Co. Ltd., U K for glass fibres.
USE GLASS FIBRES

- FIBERGLAS(R)
Tradename of Owens-Corning Fiberglas Corporation, U S A, for glass fibres, and sometimes for glass fibre reinforced plastics.
USE CLASS FIBRES

- FIBRE GLASS
USE GLASS FIBRES

- FIBREGLASS(R)
Tradename of Fibreglass Ltd., U K, for glass fibres.
USE GLASS FIBRES

FIBRE MAKING GLASSES
UF GLASS FOR GLASS FIBRES
NT A - GLASS
C - GLASS
D - GLASS
E - GLASS
L - GLASS

M - GLASS
S - GLASS
FIBRE OPTICS
RT GLASS FIBRES
FIBRE REINFORCED PLASTICS
UF FRP
RT COMPOSITE MATERIALS
FIBRES
PLASTICS
FIBRES
NT ASBESTOS FIBRES
BORON FIBRES
CARBON FIBRES
CERAMIC FIBRES
GLASS FIBRES
GRAPHITE FIBRES
HIGH SILICA FIBRES
QUARTZ FIBRES
RT COMPOSITE REINFORCING MATERIALS
FIBRE SIZE APPLICATOR
BT GLASS SILK FORMING EOUIPMENT
FIBRE SIZES
UF SIZING MATERIALS
NT PLASTIC SIZE
TEXTILE SIZE
- FIN SHIELD
USE NOZZLE SHIELD
FLUOROCARBON
BT THERMOPLASTIC MATERIALS
- FRP
USE FIBRE REINFORCED PLASTICS
GATHERING SHOE
UF COMB
RT GLASS SILK FORMING EOUIPMENT
GLASS CLOTH
UF DECORATED GLASS FABRIC
GLASS FABRIC
GLASS TEXTILES
RT GLASS FIBRES
ROVING CLOTH
GLASS CLOTH FORMING PROCESS
NT BAKING
CORONIZING
DESIGNING
PIGMENTING
WEAVING
YARN PLYING
YARN TWISTING
RT GLASS FIBRES
GLASS FABRIC
USE GLASS CLOTH
GLASS FIBRE REINFORCED PLASTICS
UF GRP
RT COMPOSITE MATERIALS
GLASS FIBRES
PLASTICS
GLASS FIBRES
UF DEEGLASsW
DURAGLAS(R)
DURAMAT(R)
EIRENGLASS(R)
FAMCO(R)
FIBERGLASS
FIBERGLASS
FIBREGLASS(R)
GLASS FILAMENTS
LIASIL(R)
MARGLASS(R)
SILENKA(R)
SPUNGLASS
TYGLAS(R)
NT GLASS SILK
GLASS WOOL
MATS
ROVINGS
SILVER
STAPLE FIBRES
STRANDS
YARN
BT FIBRES
GLASS
INORGANIC MANMADE FIBRES
RT ASBESTOS FIBRES
BORON FIBRES
CARBON FIBRES
CERAMIC FIBRES
FIBRE OPTICS
GLASS CLOTH
GLASS CLOTH FORMING PROCESS
GLASS FIBRE REINFORCED PLASTICS
GRAPHITE FIBRES
HIGH SILICA FIBRES
QUARTZ FIBRES
ROVING CLOTH
- GLASS FILAMENTS
USE GLASS FIBRES
- GLASS FOR GLASS FIBRES
USE FIBRE MAKING GLASSES
GLASS SILK
UF CONTINUOUS GLASS FILAMENT
BT GLASS FIBRES
RT SILVER
STRANDS
YARN
GLASS SILK FORMING EOUIPMENT
NT BUSHING
FIBRE SIZE APPLICATOR
GATHERING SHOE
PULL-DOWN ROLLERS
WATER SPRAY
WINDER

M - GLASS
S - GLASS

FIBRE OPTICS
RT GLASS FIBRES

FIBRE REINFORCED PLASTICS
UF FRP
RT COMPOSITE MATERIALS
FIBRES
PLASTICS

FIBRES
NT ASBESTOS FIBRES
BORON FIBRES
CARBON FIBRES
CERAMIC FIBRES
GLASS FIBRES
GRAPHITE FIBRES
HIGH SILICA FIBRES
QUARTZ FIBRES
RT COMPOSITE REINFORCING MATERIALS

FIBRE SIZE APPLICATOR
BT GLASS SILK FORMING EQUIPMENT

FIBRE SIZES
UF SIZING MATERIALS
NT PLASTIC SIZE
TEXTILE SIZE

- FIN SHIELD
USE NOZZLE SHIELD

FLUOROCARBON
BT THERMOPLASTIC MATERIALS

- FRP
USE FIBRE REINFORCED PLASTICS

GATHERING SHOE
UF COMB
RT GLASS SILK FORMING EQUIPMENT

GLASS CLOTH
UF DECORATED GLASS FABRIC
GLASS FABRIC
GLASS TEXTILES
RT GLASS FIBRES
ROVING CLOTH

GLASS CLOTH FORMING PROCESS
NT BAKING
CORONI ZING
DESIGNING
PIGMENTING
WEAVING
YARN PLYING
YARN TWISTING
RT GLASS FIBRES

GLASS FABRIC
USE GLASS CLOTH

GLASS FIBRE REINFORCED PLASTICS
UF GRP
RT COMPOSITE MATERIALS
GLASS FIBRES
PLASTICS

GLASS FIBRES
UF DEEGLASS(R)
DURAGLAS(R)
DURAMAT(R)
EIRENGLASS(R)
FAMCO(R)
FIBERGLAS(R)
FIBERGLASS
FIBREGLASS(R)
GLASS FILAMENTS
LIASIL(R)
MARGLASS(R)
SILENKA(R)
SPUNGLASS
TYGLAS(R)
NT GLASS SILK
GLASS WOOL
MATS
ROVINGS
SILVER
STAPLE FIBRES
STRANDS
YARN
BT FIBRES
GLASS
INORGANIC MANMADE FIBRES
RT ASBESTOS FIBRES
BORON FIBRES
CARBON FIBRES
CERAMIC FIBRES
FIBRE OPTICS
GLASS CLOTH
GLASS CLOTH FORMING PROCESS
GLASS FIBRE REINFORCED PLASTICS
GRAPHITE FIBRES
HIGH SILICA FIBRES
QUARTZ FIBRES
ROVING CLOTH

- GLASS FILAMENTS
USE GLASS FIBRES

- GLASS FOR GLASS FIBRES
USE FIBRE MAKING GLASSES

GLASS SILK
UF CONTINUOUS GLASS FILAMENT
BT GLASS FIBRE'S
RT SILVER
STRANDS
YARN

GLASS SILK FORMING EQUIPMENT
NT BUSHING
FIBRE SIZE APPLICATOR
GATHERING SHOE
PULL-DOWN ROLLERS
WATER SPRAY
WINDER

RT GLASS WOOL FORMING EOUIPMENT
STAPLE TEXTILE FIBRE FORMING EQUIPMENT

- GLASS TEXTILES
USE GLASS CLOTH

GLASS WOOL
BT GLASS FIBRES
RT MILLED FIBRES
STAPLE FIBRES

Note : Thesaurus of terms on glass fibres and glass fibre reinforced plastics have been displayed above in part, i. e,, from "ABS to GLASS WOOL".

CONCLUSIONS

Thesaurus approach as a mode of standardization in developing information systems, and also to make the products of information systems exchangeable from one system to another, is gaining rapid momentum. The role of UNISIST in this regard is vital through their support in the maintenance of the two clearing houses for thesauri, one at Cleveland (U S A) and the other at Warsaw (Poland), as well as to the International Information Centre for Technology in Vienna. Moreover, the guidelines, prepared by the joint efforts of UNESCO and ISO, for the establishment and development of monolingual scientific and technical thesauri for information retrieval has made the task easier for the compilers as per international standards.

5 ACKNOWLEDGEMENT

I am grateful to Shri K D Sharma, Director, Central Glass and Ceramic Research Institute, Calcutta, for his kind permission to contribute this paper to the 'Seminar on Thesaurus in Information Systems' (Bangalore) (1975 Dec 1-5), and to Dr P Sana, Scientist-in-Charge (Library) for his encouragement in preparing this paper. I am also thankful to Shri P B Roy, Librarian, Commercial Library, Calcutta for helpful discussion on the topic of the paper.

6 BIBLIOGRAPHICAL REFERENCES

1 Sec 11 BRITISH STANDARDS INSTITUTION. BS 1000(666):1971. Universal Decimal Classification, Glass and allied industries. Ceramics, clay and allied industries. Gypsum, lime, cement and allied industries. London, the Institution, 1971. 44p

Sec 11 13 SOCIETE FRANCAISE DE CERAMIOUE. Documentation Europeenne Ceramique (D E C). Paris, the Society, 1961. 50p

3 Sec 11 13 ————. Liste alphabetique des termes utilises dans la D E C. Paris, the society, 1962. 143p

4 Sec 11 14 NEELAMEGHAN (A). Glass production technology : Depth classification. Lib, Sc. 4; 1967 j Paper L ; 225-61

5 Sec 121 THAKUR (R L) & ORS. Bibliography on glass-ceramics. Calcutta, Central Glass and Ceramic Research Institute, 1974. 174p

6 Sec 121 BRITISH STANDARDS INSTITUTION. BS 3447:1962. Glossary of terms used in the glass industry. London, the Institution, 1962. 56p

7 Sec 121 LOEWENSTEIN (K L). The manufacturing technology of continuous glass fibres. Amsterdam, Elsevier, 1973.

8 Sec 121 131 141 231 ENGINEERS JOINT COUNCIL. Thesaurus of engineering and scientific terms : a list of scientific and engineering terms and their relationships for use in a vocabulary for indexing and retrieving technical information. New York, the Council. 1967

9 Sec 231 ENGLISH ELECTRIC COMPANY. Thesaurofacet: a thesaurus and faceted classification for engineering and related subjects ; compiled by Jean Aitchison, *h.* others. Whetstone, the Company, 1969

10 Sec 231 FIELD (B J). A thesaurus-based indexing and classification system developed for INSPEC products and services. J Doc. 30; 1974; 1-17

11 Sec 231 SHEPHERD (M) and WATTERS (C). Computer-generation of thesaurus. Lib. Sc. 12; 1975; Paper E.