

This heading is concerned with modifying the physical composition or structure of a crystalline or crystallizable material by crystallizing or recrystallizing the material along a controlled path. Local melting of such a material along a controlled path to remove a residual impurity is also met here

Explanation of heading subject matter and relationships with other headings

This heading is largely concerned with processes and apparatus for crystallizing a crystallizable material, or recrystallizing a crystalline material, along a controlled path in order to purify or otherwise modify its physical composition or structure. The physical modification, *eg* as in the introduction of a dopant in a semiconductor crystal, may be effected primarily to influence the electronic properties of the material. Aspects of processes and apparatus which are not concerned with the maintaining or setting up of a controlled path or direction of crystal growth are generally subject matter for other headings, *eg* optical refracting apparatus for monitoring meniscus curvature at a phase boundary—G2J, Optical apparatus &c. Affinity exists with heading C7F, Coating with metals, inorganic compounds &c, in respect of vapour phase epitaxial growth

Also included in this heading are processes and apparatus for producing a controlled path for local melting of a crystalline material to remove a residual impurity where no subsequent recrystallization may take place. Affinity exists with heading B6J, Engraving, etching and embossing in this respect. Affinity also exists with heading H1K, Electric solid-state devices &c in respect of crystallization processes to produce or modify a specific circuit element body or a part or region thereof

Excluded are:

- . crystallization from a body of liquid not along a controlled path—B1G, Crystallizing from a liquid &c
- . processes for producing crystalline products other than by crystallizing along a controlled path—headings appropriate to those products, *eg* C1A, Inorganic substances; C7A, Alloys &c
- . products of crystallizing processes in which the interest resides in a particular product *per se*—headings appropriate to the product *eg* C1A, Inorganic substances; C7A, Alloys &c; H1K, Electric solid-state devices &c

The exclusion references in this heading are not exhaustive. Reference should be made to the appropriate general heading/s for processes, materials, elements or devices which may be more widely applicable than can appropriately be classified in this heading

Relationship with the Universal Indexing Schedules (heading U1S)

In addition to recording the nature of broader processes or apparatus with or in which inventions classified here may be used, U1S is used, subject to its indexing rules, to index materials operated on and useful products obtained

Operative date for Key entries

The operative date of terms in this heading is Edition G

Notes on use of classifying and indexing terms

1. The classifying schedule is divided into two groups of terms. Terms in the first group, 1 are used to identify significant disclosures as associations or by means of the crystallizing process specified. Apart from terms SH, SS, SX and SXX which have no group 2 part, the group 1 terms provide a prefix part code which should be combined with a suffix part code selected from the second group, 2 terms to form a complete classifying term
2. Indexing Schedule 1 contains terms which correspond to the functional aspects identified in the group 2 classifying terms. These indexing terms are suffix part terms to be combined with a term selected from *any* of the group 1 classifying terms apart from SXX. Discretion is used when applying these terms: a complete term being applied whenever it is necessary to identify the disclosure of a technical subject, in addition to that identified by a complete term from the classifying schedule. Terms from within Indexing Schedule 1 should not be used in mutual combination when searching
3. The use of a term from Indexing Schedule 1 is mandatory following the application of a complete classifying term containing a part code identified by the note "see Indexing Schedule 1". Thus classifying terms of the form SAA—, SAB—, SH, SS, SX, —A or —B may be combined with a term from Indexing Schedule 1 when searching
4. When searching on a classifying term with a suffix part —DAA to —EX it may be considered necessary to also search on the corresponding term from Indexing Schedule 1. Conversely a search using a term from Indexing Schedule 1 will have to be extended by additionally searching on the corresponding classifying term (—DAA to —EX) for completeness

Classifying ScheduleGROUP 1

- Notes:
1. This group of terms, apart from terms coded SH, SS, SX or SXX, form prefix parts to be combined with a suffix part from the list of Group 2 terms following to generate a complete classification code. Thus only codes SH, SS, SX and SXX exist as complete codes with no Group 2 counterpart
 2. Any of the Group 1 terms, apart from term SXX, may also be used as the prefix part of a post co-ordinated indexing term formed by combination with a term selected from the list of suffix terms in Indexing Schedule 1

Purifying, crystallizing or otherwise modifying physical composition or structure of crystalline or crystallizable material by crystallizing, recrystallizing or local melting along a controlled path or paths

. See Indexing Schedules 1-3

SAA— association with operations external to the subject matter of this heading
. See Indexing Schedule 1

SAB— plurality of functionally distinct crystallizing processes below in association or as alternatives in association with an aspect identified by a Group 2 part-term
. See Indexing Schedule 1

crystallizing—

. from a liquid phase—

SB— . . crystal pulling (*other than* as in SC—*below*)

SC— . . zone melting

SE— . . epitaxial growth

SF— . . normal freezing or freezing along a temperature gradient (*eg* bridgeman method, Kryopoulus method)
other than above

SH . . other liquid phase processes, *eg* electromigration

. . . See Indexing Schedule 1

. from a gaseous or like phase—

SJ— . . epitaxial growth (affinity exists with Heading C7F, Coating with metals, inorganic compounds &c)

SR— . . other than above

SS . directly in the solid state

. . See Indexing Schedule 1

SX . unspecified or inconsequential, *ie* with interest lying only in an aspect identified by a Group 2 term

. . See Indexing Schedule 1

SXX purifying crystalline material by local melting along a controlled path

GROUP 2

Note: This group of terms are suffix part terms to be combined with a prefix part term from the list of Group 1 terms above to generate a complete classification code

—A plural process
. See Indexing Schedule 1
. plural growth from a single substrate by masking—*See* term —DJ *below*

—B overall organisation *including* associations of functional aspects *below*
. See Indexing Schedule 1

—C control, command or monitoring system
. sensing special properties—*See* Indexing Schedule 3

Group 2—*cont*

functional aspects—

. adding material to or removing excess material from the crystallizing or molten zone—

. . doping material—

—DAA . . . in the form of a gas or vapour (*including* atmospheric)

—DAB . . . combined with crystallizing material

—DAG . . . other than above, *including* combinations of or with the *above*

. . crystallizing material or reactants *other than above*—

—DAH . . . the material being replenished entirely by addition of solids or liquids, *eg* the Verneuil method in temperature gradient freezing

—DAX . . . other than above or unspecified

. manipulation or stabilisation of the melt meniscus adjacent the growth region, *eg* to modify cross-section—

—DEE . . edge defined film fed growth

—DEF . . using shaping guides *other than above*

—DEX . . other than above

. maintaining the temperature of the molten zone *other than* as in terms —DEE to —DEX *above* by—

—DHA . . direct contact with a heating element

—DHB . . electromagnetic induction

—DHC . . irradiation *other than above*

—DHD . . heat shielding or reflective insulation

—DHX . . interactive combinations of the above and other means (*including* thermal capacity fluid bath or plasma)

—DJ . growth characterised by particular aspects of the substrate, seed or the like

—DM . aspects concerning relative movement between the melt and crystal

—DN . enclosing of melt by protective material, *eg* fluid

—DX . other functional aspects, *including* after treatments, apparatus material

apparatus detail *other than above*—

—EC . crucible or melt container construction

—EX . other apparatus detail

Indexing Schedule 1

- Notes:
1. Terms from this schedule are suffix part terms, *eg* of the form—DE15, to be associated with a prefix part selected from the list of Group 1 terms apart from term SXX, *eg* of the form SB—, above to produce complete indexing terms *eg* of the form SBDE15
 2. Use of discretion: a term is applied using this schedule whenever it is necessary to identify the disclosure of a technical subject in addition to that primarily identified by using a term from the classifying schedule
 3. The use of a term from this schedule is mandatory following the use of a classifying term identified by the expression “*See Indexing Schedule 1*”

functional aspects—

. adding material to or removing excess material from the crystallizing or molten zone, the material being—

. . doping material—

—DA11 . . . in the form of a gas or vapour

—DA12 . . . combined with crystallizing material

—DA17 . . . other than above, *including* more than one doping method specified

. . crystallizing material or reactants *other than above*—

—DA18 . . . the material being replenished entirely by addition of solids or liquids, *eg* Verneuil method

—DA32 . . . other than above or unspecified

. manipulation or stabilisation of the melt meniscus adjacent the growth region, *eg* to modify growth cross-section—

—DE15 . . edge defined film fed growth

—DE16 . . using shaping guides *other than above*

—DE32 . . other than above

. maintaining the temperature of the molten zone by—

—DH11 . . direct contact with a heating element

—DH12 . . electromagnetic induction

—DH13 . . irradiation *other than above*

—DH14 . . heat shielding or reflective insulation

—DH32 . . other means, *including* more than one temperature maintaining method specified

—DJ10 . growth characterised by particular aspects of the substrate, seed or the like

—DM10 . aspects concerning relative movement between the melt and crystal

—DN10 . enclosing of melt by protective material, *eg* fluid

—DX10 . other functional aspects, *including* after treatments, apparatus materials

apparatus detail *other than above*—

—EC10 . crucible or melt container construction

—EX10 . other apparatus detail

Indexing Schedule 2 (materials of crystal or melt)

Note: terms from this schedule are applied in a non-discretionary manner

- elements—
- S102 . silicon
S103 . germanium
S109 . others
- inorganic compounds or compositions—
- S111 . with formula $A_3Me_5O_{12}$ where A is a rare earth metal and Me is Fe, Ge, Sc, Cr, Co or Al, *eg* garnets
S112 . niobates, vanadates, tantalates
S118 . other complex oxides
S119 . oxides other than above
- . group III, V compounds, *including* ternary compounds—
- S121 . . gallium arsenide
S122 . . gallium phosphide
S129 . . others
- S130 . group II, VI compounds, *including* ternary compounds—
- S140 . alloys; eutectics
- S150 . others
- S160 organic compounds or compositions

Indexing Schedule 3 (sensing special properties)

Note: terms from this schedule are applied in a non-discretionary manner and are mandatory following the application of the classifying part term —C when a special property is sensed

- properties sensed—
- S210 . X-ray diffraction
S211 . meniscus curvature
S219 . other