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Datasheet for the decision of 18 January 2011

Case Number: T 1819/08 - 3.3.05

Application Number: 99954615.3

Publication Number: 1113986

IPC: C01B 33/00

Language of the proceedings: EN

Title of invention:
Inventory control

Applicant:
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Opponent:
-

Headword:
Semiconductor nanocrystals/MIT

Relevant legal provisions:
EPC Art. 54(1)(2), 123(2)

Relevant legal provisions (EPC 1973):
-

Keyword:
"Main, first and second auxiliary requests: Novelty (no)"
"Third, fourth and fifth auxiliary requests: Added subject-matter (yes)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1819/08 **-** 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 18 January 2011

Appellant: MASSACHUSETTS INSTITUTE OF TECHNOLOGY
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 13 March 2008 refusing European patent application No. 99954615.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: G. Raths
Members: J.-M. Schwaller
C. Vallet

Summary of Facts and Submissions

I. This appeal lies from the decision of the examining division refusing European patent application No. 99 954 615.3 on the grounds that the subject-matter of the claims 1 according to the main and first and second auxiliary requests lacked novelty with respect to document

D1: US 5 625 456

and that the subject-matter of the claims 1 according to the third, fourth and fifth auxiliary requests infringed Article 123(2) EPC.

II. The statement setting out the grounds of the appeal was filed on 14 July 2008, together with six sets of claims respectively as the main request and auxiliary requests 1 to 5.

Claim 1 of the respective requests read as follows:

Main request

"1. A composition comprising more than one particle size distribution of semiconductor nanocrystals, and an item of interest associated with the composition to provide a nanocrystal-item of interest conjugate, wherein each particle size distribution has a distinct characteristic spectral emission."

Auxiliary request 1

"1. A composition comprising more than one population of semiconductor nanocrystals each population having a particle size distribution of, and an item of interest associated with the composition to provide a nanocrystal-item of interest conjugate, wherein each particle size distribution has a distinct characteristic spectral emission."

Auxiliary request 2

"1. A composition comprising more than one particle size distribution of semiconductor nanocrystals, and an item of interest associated with the composition to provide a nanocrystal-item of interest conjugate, wherein each particle size distribution has a distinct characteristic spectral emission, and the characteristic spectral emission is a wavelength of emitted light or both an intensity of emitted light and a wavelength of emitted light."

Auxiliary request 3

"1. A composition comprising more than one particle size distribution of semiconductor nanocrystals, and an item of interest associated with the composition to provide a nanocrystal-item of interest conjugate, wherein each particle size distribution has a distinct characteristic spectral emission, and the characteristic spectral emission is a wavelength of emitted light or both an intensity of emitted light and a wavelength of emitted light, and each semiconductor nanocrystal includes an organic surface that is associated with a support."

Auxiliary request 4

"1. A composition comprising a first particle size distribution of semiconductor nanocrystals having a first item of interest associated with each nanocrystal thereof to provide first nanocrystal-item of interest conjugates, and a second particle size distribution of semiconductor nanocrystals having a second item of interest associated with each nanocrystal thereof to provide second nanocrystal-item of interest conjugates, wherein the first particle size distribution has a distinct characteristic spectral emission to the second particle size distribution, and each semiconductor nanocrystal is coated with an organic capping agent that is physically linked by covalent chemical bond, van der Waals force or by hydrophobic interaction with a support, and the support is in the form of a bead, a pellet, a disk, a capillary, a hollow fiber, a needle or a solid fiber."

Auxiliary request 5

"1. A composition comprising more than one particle size distribution of semiconductor nanocrystals, and an item of interest associated with the composition to provide a nanocrystal-item of interest conjugate, wherein each particle size distribution has a distinct characteristic spectral emission, and each semiconductor nanocrystal includes an organic surface that is physically linked by covalent chemical bond, van der Waals force or a hydrophobic interaction with a support, and the support is in the form of a bead, a pellet, a disk, a capillary, a hollow fiber, a needle or a solid fiber."

The appellant requested that the contested decision be set aside and that a patent be granted on the basis of one of said requests.

III. On 29 September 2010, the appellant was summoned to oral proceedings.

IV. In a communication dated 23 December 2010, the board informed the appellant of its preliminary opinion that the subject-matter of the claims 1 of the main and auxiliary requests 1 to 3 appeared to lack novelty in the light of document D1 and that the claims 1 of auxiliary requests 3, 4 and 5 infringed Article 123(2) EPC.

The board drew the appellant's attention in particular to the content of document

D4: "*Synthesis and Characterization of Nearly Monodisperse CdE (E= S, Se, Te) Semiconductor Nanocrystallites*", C.B. Murray et al., J. Am. Chem. Soc. 1993, vol. 115, pages 8706 to 8715,

which was referred to both in D1 and in the application in suit.

The board also drew the appellant's attention to Articles 13 and 15 RPBA.

V. With a letter dated 5 January 2011, the appellant withdrew its request for oral proceedings.

VI. With a fax dated 17 January 2011 - received at 20.19 hrs at the EPO - the appellant submitted observations in support of the novelty of the subject-matter claimed. It also informed the board of its intention to file a revised version of auxiliary requests 4 and 5.

VII. Oral proceedings took place as announced on 18 January 2011 in the absence of the appellant. After having closed the debate, the chairman announced the decision and closed the oral proceedings at 10.20 hrs.

VIII. On the same day the appellant submitted revised auxiliary requests 4 and 5. These requests have however been received on the fax machine of the EPO at 11.26 hrs, i.e. when the board was no longer competent.

IX. The requests on which the board had to decide were therefore those which were valid before the closure of the oral proceedings, i.e. those dated 14 July 2008 (see point II. above).

Reasons for the Decision

1. *Main request - Novelty*

1.1 D1 (claim 1) discloses a method for identifying an object, comprising the steps of:

- providing individual objects within a predetermined class of objects with a gain medium comprised of an electromagnetic radiation emitting and amplifying first phase and an electromagnetic radiation

scattering second phase, the gain medium being responsive to electromagnetic radiation having a first wavelength for emitting electromagnetic radiation with wavelengths within a predetermined band of wavelengths;

– irradiating the objects with the first wavelength; detecting an emission from the irradiated objects, the emission including one or more second wavelengths that are within the predetermined band of wavelengths; and

– identifying an object as belonging to a predetermined class of objects from the detected emission.

According to D1, column 20, lines 45 to 52, the gain medium is a multi-phase system the first phase of which is an electromagnetic radiation emission and amplifying phase which may comprise one or **more types of** dye molecules and/or **semiconductor nanocrystals**.

For further details regarding the semiconductor nanocrystals, D1 (column 20, line 65 to column 21, line 5) makes reference to a document (D4) which "teaches a method to produce semiconductor nanocrystals or crystallites, from approximately 12 Å to approximately 115 Å in diameter, which are suitable for use in practising this invention".

1.2 The question now arises whether D1 discloses the other features of claim 1, namely "more than one particle size distribution of semiconductor nanocrystals" and

"each particle size distribution has a distinct characteristic spectral emission".

The board has no doubt that these features are directly and unambiguously disclosed in D1, in particular in the embodiments according to Figures 10a and 10b, reproduced hereinafter

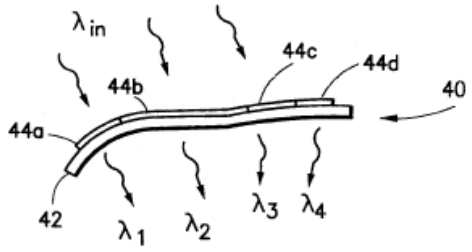

FIG. 10a

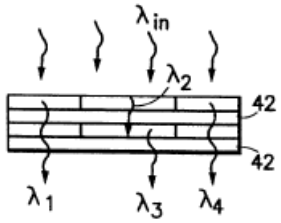

FIG. 10b

and wherein a plurality of regions or layers are formed upon a surface of a transparent substrate for simultaneously providing a plurality of different output wavelengths in response to an input wavelength, with each region or layer 44a to 44d containing dye molecules selected for providing a desired output wavelength (λ_1, λ_2, λ_3, λ_4) in response to an input wavelength (λ_{in}) provided from a suitable laser source. Furthermore, when the regions or layers 44a to 44d are simultaneously illuminated then the **plurality** of output

wavelengths are simultaneously emitted (column 10, line 58 to column 11, line 4).

So, the embodiments disclosed in Figures 10a and 10b directly and unambiguously disclose the use of different dyes, with each dye having a distinct characteristic spectral emission.

In the next paragraph (column 11, lines 6 to 12), D1 discloses that one valuable application for the structure 40 in Figure 10a is to provide a plurality of different wavelengths to a surface of the skin when removing undesirable skin pigments, such as port wine stain and tattoos. In this case, the regions 44a to 44d are formed in the shape of the pigment area to be removed, with **each region containing**, for example, a dye molecule or **semiconductor particles**, **selected to emit a wavelength that is strongly absorbed by the underlying pigment**.

So, in this specific embodiment, D1 directly and unambiguously discloses the use of distinct populations of semiconductor particles for providing a plurality of different wavelengths, with the distinct populations being located in different regions of one "item of interest".

Concerning specifically the specific use of semiconductors as the emitting and amplifying phase, D1 (column 20, lines 50 to 53 and column 20, line 65 to column 21) explicitly makes reference to D4 which discloses (see abstract) the preparation of high-quality CdE (E = S, Se, Te) **semiconductor nanocrystallites** having a diameter of from 12 Å to 115

Å with consistent crystal structure and a high degree of monodispersity. D4 further explains in its abstract that the high sample quality of the nanocrystallites results in sharp absorption features and strong "band-edge" emission which is **tunable** with particle size and choice of material.

So, D4's abstract discloses that the semiconductor nanocrystallites referred to in D1 have emission characteristics which can be varied in accordance with the semiconductor's particle size and material.

Since D4 is precisely also the document referred to in the application as filed (see page 15, lines 23 to 25) regarding the semiconductor nanocrystals supposed to be used in the invention as defined in claim 1 at issue, the board has no doubt that the semiconductor nanocrystals in question in claim 1 at issue are strictly identical with those referred to in D1. For the above reasons, the disclosure of D1 can be read directly and unambiguously in the wording of claim 1 at issue, which therefore is not novel pursuant to Article 54(1) and (2) EPC.

1.3 According to the appellant, D1 is not novelty-destroying because according to the passage at column 9, lines 11 to 14, even if different emission wavelengths were emitted from one object, they were modified, scattered and amplified to create an intense, monochromatic single wavelength.

The board cannot accept this argument, because the passage referred to by the appellant is in fact extracted from a broader passage (D1, column 9, lines 1

to 14) which does not deal with the embodiments in Figures 10a and 10b, but which refers to "a population of dye molecules", i.e. dye molecules having the same colour, not to an object bearing different regions or layers with distinct types of dyes or semiconductors. Furthermore, as explained in point 2.2, it is indisputable that in the embodiments according to Figures 10a and 10b, different wavelengths are emitted from the material and no transformation into a monochromatic emission is carried out in these embodiments.

2. *Auxiliary request 1 - Novelty*

2.1 The subject-matter of claim 1 of this request differs from that of claim 1 of the main request in that the composition comprises more than one "population of semiconductor nanocrystals each population having a particle size distribution", instead of more than "one particle size distribution of semiconductor nanocrystals" in claim 1 of the main request.

2.2 The board observes that the distinct types of semiconductors - in the regions 44a to 44d disclosed in D1, Figures 10a or 10b - each represent a different "population of semiconductor nanocrystals" and each of such "population" implicitly has a distinct "particle size distribution", and so the embodiment in Figure 10a or 10b in D1 also anticipates under Article 54(1) and (2) EPC the subject-matter of claim 1 of auxiliary request 1.

3. *Auxiliary request 2 - Novelty*

3.1 The subject-matter of claim 1 of this request differs from that of claim 1 of the main request in that the characteristic spectral emission is further defined as being "a wavelength of emitted light or both an intensity of emitted light and a wavelength of emitted light".

3.2 As explained in item 2.2., last paragraph, the semiconductor nanocrystallites specifically described in the application in suit are exactly the same as those described in D1 (via D4). As a consequence, they necessarily have the same spectral emission properties. Furthermore, it can be seen from D4, Figure 5 (reproduced hereinafter) that the emission line

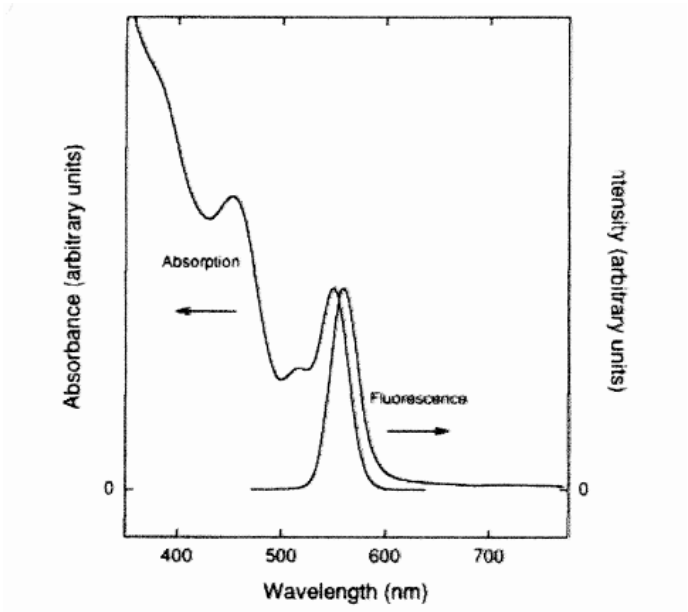

Figure 5. Typical room temperature band edge luminescence and absorption spectra for 35 Å diameter CdSe crystallites. No deep trap luminescence is detected.

of a sample of 35Å diameter CdSe crystallites is approximately at 565 nm, which is a "wavelength of emitted light" in the sense of claim 1 of this request, which is therefore not novel within the meaning of Article 54(1) and (2) EPC.

4. *Auxiliary request 3 - Article 123(2) EPC*

4.1 The subject-matter of claim 1 of this request differs from that of claim 1 of auxiliary request 2 by the additional feature that "each semiconductor nanocrystal includes an organic surface that is associated with a support".

4.2 The board did not find any literal basis in the application as filed for this amendment, and at page 10, lines 5 and 6, the application discloses that a semiconductor nanocrystal is, optionally, surrounded by a "coat" of an organic capping agent. This is however not a basis for the more generic expression that "each semiconductor nanocrystal **includes** an organic surface" now defined in claim 1.

The appellant stated that a basis for amended claim 1 of this request was to be found in the following passages of the application as filed: claim 2; page 17, line 19 to page 19, line 27; page 27, line 22 to page 28, line 13.

The board observes that while claim 2 is totally silent as to the presence of any organic compound in the "semiconductor nanocrystal", the passage at page 17, line 19 to page 19, line 27 of the application as filed discloses inter alia that:

- most semiconductor nanocrystals are prepared in coordinating solvent, such as trioctylphosphine oxide (TOPO) and trioctylphosphine (TOP) resulting in the formation of a passivating organic layer on the dot surface comprised of the organic solvent;

- in the case of water-soluble semiconductor nanocrystals, the outer layer includes a compound having at least one linking moiety that attaches to the surface of the particle and that terminates in at least one hydrophilic moiety;

- it may be desirable to associate the semiconductor nanocrystals with a particular solvent or liquid, such as pyridine, and so the surface can be specifically modified with pyridine or pyridine-like moieties to ensure solvation;

- the surface layer can be modified to render the semiconductor nanocrystal reactive for a particular coupling reaction, and so, for instance, modified semiconductor nanocrystals with amine, styrene or acrylate-containing moieties can be produced.

The other passage - at page 27, line 22 to page 28, line 13 - discloses that the semiconductor nanocrystals can be functionalised with styrene or with a carboxylate moiety.

Hence, none of the passages quoted by the appellant discloses the expression "organic surface" in the generic form proposed in amended claim 1.

Therefore, it is concluded that claim 1 of this request has been amended in such a way that it contains subject-matter which extends beyond the content of the application as filed, which infringes Article 123(2) EPC.

5. *Auxiliary request 4 - Article 123(2) EPC*

5.1 Claim 1 of this request comprises in particular the amendment that "each semiconductor nanocrystal is coated with an organic capping agent that is physically linked by covalent chemical bond, van der Waals force or by hydrophobic interaction with a support".

5.2 The board observes that although the application as filed discloses (page 10, lines 5 and 6) a semiconductor nanocrystal, optionally, surrounded by a "coat" of an organic capping agent, this passage does not disclose that the organic capping agent is "physically linked by covalent chemical bond, van der Waals force or by hydrophobic interaction with a support".

The appellant stated that a basis for this amendment was to be found in the passages already cited in point 5.2 above and at page 12, lines 25 to 27.

The board notes that the passage at page 12, lines 25 to 27 explains that the phrase "associated with" is used in the application as filed to indicate items that "are physically linked by, for example, covalent chemical bonds, physical forces such as Van der Waals or hydrophobic interactions, encapsulation, embedding, or the like". It does not however disclose that the organic capping agent is "physically linked by covalent chemical bond, van der Waals force or by hydrophobic interaction with a support".

The passages cited in point 5.2 above also do not directly and unambiguously disclose the above amendment,

and therefore it must be concluded that the subject-matter of claim 1 of this request extends beyond the content of the application as filed, contrary to Article 123(2) EPC.

6. *Auxiliary request 5 - Article 123(2) EPC*

Claim 1 of this request comprises in particular the amendment that "each semiconductor nanocrystal includes an organic surface".

This amendment having already been considered in this decision in amended claim 1 according to the auxiliary request 3, the same reasons apply mutatis mutandis (see item 5.2 above), and therefore claim 1 of this request also infringes Article 123(2) EPC.

7. In conclusion, as none of the claims 1 of the different requests on file meet the requirements of the EPC, none of the requests on file is allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman

C. Vodz G. Raths