

Claims:

1. A composite material comprising elemental gold, amyloid fibrils and a polymer, characterized in that
 - said elemental gold is present as single crystal gold platelets; and
 - said elemental gold is homogenously distributed within said polymer; and
 - said composite material having a density in the range of 0.7 - 3.9 g/cm³.
2. The composite material according to claim 1, wherein said gold
 - is present as single crystal gold platelets, with the size up to 20 μm and the thickness only of 100 nm or less; and/or
 - amounts to 10-99 weight-%, preferably 30 - 99% of the total weight of the composite material.
3. The composite material according to claim 1 or 2, wherein said polymer
 - is obtained from a colloidal latex and / or
 - is selected from the group of polyolefines, polyacrylates and polystyrenes, particularly polystyrenes.
4. The composite material according to any of the preceding claims, wherein said amyloid fibrils
 - have high aspect ratio, preferably with ≤ 10 nm in diameter and $\geq 1\mu\text{m}$ in length, and / or
 - have highly charged surfaces, preferably electrophoretic mobilities of the order of $2 \cdot 10^{-8} \text{m}^2/\text{V} \cdot \text{s}$ at pH 4, as measured by electrophoretic light scattering.
5. The composite material according to any of the preceding claims, having

- a homogeneous microstructure in which said gold platelets retain a golden shining and are embedded in the polymer matrix; and / or
 - a density of preferably of 1.5 - 3.9 g/cm³,
5 preferably of 2.5 - 3.5 g/cm³; and / or
 - a T_g of 80 - 120 °C; as measured by DSC and / or
 - a porosity of less than 80%.
6. The composite material according to any of the
10 preceding claims, in the form of
- a shaped article,
 - a self-supporting film;
 - a coating on a substrate.
- 15 7. A method for manufacturing a composite material according to any of claims 1 to 6, said method comprising the steps of :
- (a) providing a first aqueous composition comprising amyloid fibrils-Gold crystals and a second
20 aqueous composition comprising a polymer latex;
 - (b) combining said first and second composition followed by controlled increase of ionic strength to thereby obtain an organic-inorganic hydrogel; and
 - (c) converting the thus obtained hydrogel into an
25 aerogel by removing the solvent; and then
 - (d) annealing the thus obtained aerogel at elevated temperatures, to thereby obtain the composite material.
- 30 8. The method according to claim 7, wherein in step (a):
- said amyloid fibrils were prepared with food-grade proteins; preferably selected from the group consisting of β -lactoglobulin, lysozyme, ovalbumin, and serum albumines; and / or
 - 35 • said single crystal gold platelets are prepared by reducing an aqueous solution of gold salts which is stabilized with amyloid fibrils in colloidal state, preferably β -lactoglobulin in colloidal state.

9. The method according to any of claims 7 to 8, wherein
- in said step (b) the combined compositions are contacted with a saline solution via a diaphragm;
 - 5 and /or
 - In said step (c) water is replaced by a low boiling organic solvent prior to solvent removal and / or scCO_2 is used to remove solvent; and / or
 - In said step (d) annealing takes place at reduced
 - 10 pressure, preferably 10 - 100 mbar.
10. The method according to any of claims 7 to 9, additionally comprising one or more further steps (e), said further steps preferably being selected
- 15 from polishing (e1), casting (e2), and coating of a substrate (e3).
11. A composite material obtainable by, or obtained according to the method of any of claims 7 to 10.
- 20 12. An article comprising or consisting of a composite material according to any of claims 1-5.
13. The article of claim 12, selected from the group
- 25 consisting of
- decorative articles, which are partly or fully coated with the composite according to claim 1 - 5 or which are printed with an ink comprising the composite according to claim 1 - 5;
 - 30 • ornamental articles containing of a composite material according to any of claims 1 - 5;
 - electrical devices, comprising a composite material according to any of claims 1 - 5; and
 - catalytic material, either in the form of monolith
 - 35 or in the form of granules / pellets.