Claims

1. An inorganic pigment with the function of a light-activated catalyst but also in the absence of light comprising:

- a first layer composed of a semiconductor metal oxide selected from TiO_2, rutile or anatase, preferably rutile, with high dielectric constant characterized by a relative permittivity ε_r in the range 60-100, for industrial use with a size in the range 220 nm up to at 4 μm,
- a second layer called a two-dimensional pseudo-perovskite layer which consists of inorganic ferroelectric structures of the perovskite or pseudo-perovskite type of the ABO_3 or $A_2B_2O_6$ form, and
- a third layer consisting of nanometric metal clusters wherein the metal is selected from Cu, Ag or Au, and the clusters that are deposited on the structure of the second layer.

2. The inorganic pigment according to claim 1, wherein the second layer, called the two-dimensional pseudo-perovskite phase layer, consists of molecular octahedra of TiO_2, which form the surface of the interface of the first layer, between which alkaline earth metal cations are inserted, preferably Ca^{2+} or Ba^{2+}, which form a perovskite or pseudo-perovskite ferroelectric inorganic structure of type ABO_3 or $A_2B_2O_6$ where the "O" type anion and the "B" type cation are represented by the oxygen anions and titanium cations of the molecular octahedra of TiO_2 from the composition of the surface of the first layer interface, and the "A" type cation is represented by the intrusions of alkaline earth metals, preferably Ca^{2+} or Ba^{2+}, which are coordinated to the "O" anions of TiO_2 molecular octahedra in the layout of the surface of the first layer interface.

3. The inorganic pigment according to any of the preceding claims wherein the perovskite or pseudo-perovskite inorganic ferroelectric structures of type ABO_3 or $A_2B_2O_6$ contain Titanium as a "B" type transition metal, preferably rutile titanium, Calcium or Barium as alkaline earth metals, preferably Calcium, like cation type "A" and anion "O" is Oxygen.

4. An inorganic pigment according to any of the preceding claims wherein the third layer consists of metal nanometric clusters of Cu, Ag or Au, preferably Cu, which are deposited on the structure of the second layer.

5. An inorganic pigment according to claim 4 wherein the metal clusters deposited on the structure of the second layer have a thickness of from 1 (one) to 5

(five) metal atoms but not more than 1 nm thick with a length in the range of at 1 nm to 50 nm.

6. A process for obtaining the inorganic pigment with the function of light-activated catalyst but also in the absence of light according to claims 1-5, comprising the following steps:

a) to a basic NaOH 1M solution is added an amount of semiconductor metal oxide selected from TiO_2, anatase or rutile, preferably rutile, where the ratio between the mass of NaOH and the mass of semiconductor metal oxide is in the range of 1 to 8 parts until 1 part to 10 parts by weight and shake well for at least 30 minutes at room temperature to decontaminate the surface of the semiconductor metal oxide from any impurities and to activate the oxygen centers on its surface;

b) to the stirred solution from point (a) is added an amount of $M(OH)_2$ where M is chosen from Ca and Ba, preferably Ca, and where the ratio between the mass of $M(OH)_2$ and semiconductor metal oxide added in step a) is in the range of 1:5 parts in weight to 1:10 parts by weight, preferably 1:5 parts by weight, and stirring is continued for at least 30 minutes;

c) an amount of M'X where M'X is selected from $CuSO_4$, $AgNO_3$ or $AuNO_3$, preferably $CuSO_4$, is added to the solution from the previous step where the ratio between the mass of M'X and the semiconductor metal oxide added in step b is in the range 1 to 8 parts by weight up to 1 to 25 parts by weight, preferably 1 to 12 parts by weight;

d) continue stirring the solution for at least 15 minutes at room temperature, then increase the temperature, under continuous stirring, to boiling water with continued stirring until the volume of the solution decreases by half and the solution acquires the structure of a thick cream;

e) leave the product obtained in the previous stage at rest for 24 hours for maturation.

7. The process for obtaining the inorganic pigment of claim 6 wherein:

- the semiconductor metal oxide is TiO_2, rutile or anatase, preferably rutile, with high dielectric constant characterized by a relative permittivity ε_r in the range 60-100, for industrial use with the size in the range 220 nm to 4 μm;
- M is chosen from Ca and Ba, preferably Ca, and
- M'X where selected from $CuSO_4$, Ag NO_3 or Au NO_3, preferably $CuSO_4$.

8. The process for obtaining the inorganic pigment of claims 6-7 wherein the metal nanometric clusters deposited on the structure of the second layer have a thickness of from 1 (one) to 5 (five) metal atoms but not more than 1 nm thick with a length in the range of 1 nm to 50 nm.

9. Formulations comprising the inorganic pigment with the function of light-activated catalyst but also in the absence of light according to any one of the preceding claims selected from any formulation suitable for covering surfaces with a decorative or protective role, preferably of paints, resins, plastics polymeric, ceramic glazes, or industrial ceramics.

10. Construction materials comprising the inorganic pigment with the function of light-activated catalyst but also in the absence of light according to any one of the preceding claims selected from plasters, plastics or mortar, plastic or unplasticized paper or paperboard, polymeric protective membranes, and bituminous, self-curing coatings, asphalt or asphalt or bituminous mixtures, self-curing building slabs or fillers, added powders which give them catalytic properties.

11. Cosmetic products comprising the inorganic pigment with the function of light-activated catalyst but also in the absence of light according to any one of the preceding claims selected from the class of dermatological products with antibacterial effect by application to the skin, preferably creams, ointments, suspensions, aqueous solutions.

12. A method of destroying pathogens comprising applying a formulation containing as active ingredient the pigment of any one of claims 1-6 comprising the following steps:

- application of the formulation on the surface to be sanitized
- and optionally, its exposure to light radiation in the visible range or in the absence of light.

13. Use of the inorganic pigment according to any of claims 1 to 5 as an industrial catalyst for chemical syntheses.

14. Use of the inorganic pigment according to any of claims 1 to 5 for the manufacture of electrodes for electrochemical photo-dissociation of water or ionic substances.

15. A depollution product in liquid, gel or solid form comprising the inorganic pigment according to any of claims 1 to 5 for use in removing oil residues.