CLAIMS

1. Permanently polarized hydroxyapatite, characterized in that its crystallinity is over 65% and its corresponding ^{31}P NMR spectrum shows a unique peak at 2.6 ppm corresponding to phosphate groups of hydroxyapatite, wherein said spectrum is carried out with solid hydroxyapatite using H_3PO_4 as a reference.

2. Process for obtaining a permanently polarized hydroxyapatite, according to claim 1, comprising the steps of:

(a) obtaining sintered samples of hydroxyapatite and/or amorphous calcium phosphate at a temperature between 700 ºC and 1200 ºC;

(b) applying a constant or variable DC voltage between 250 V and 2500 V or an equivalent electric field between 1.49 kV/cm and 15 kV/cm for at least 1 minute at a temperature between at least 1000ºC and 1200 ºC or

applying an electrostatic discharge between 2500 V and 1500000 V or an equivalent electric field between 148.9 kV/cm and 8928 kV/cm for less than 10 minutes at a temperature between at least 1000ºC and 1200 ºC;

(d) cooling the samples while applying the constant or variable DC voltage or the equivalent electric field or

cooling the samples while applying the electrostatic discharge or the equivalent electric field.

3. Process according to claim 2, wherein the sintered samples of hydroxyapatite obtained in step a) are selected from the group consisting of sintered samples of crystalline hydroxyapatite, sintered samples of amorphous hydroxyapatite and a mixture of said sintered samples.

4. Process according to claim 2 or 3, wherein the sintered samples obtained in step a) are sintered samples of crystalline hydroxyapatite and amorphous calcium phosphate.

5. Composition or material comprising the permanently polarized hydroxyapatite according to claim 1.

6. Composition or material according to claim 5, further comprising at least one of the followings: silicates; biocompatible polymers selected from polylactic acid (PLA), poly lactic-co-glycolic acid (PGLA), polyglycolide (PGA), polydioxanone (PDO),

polyhydroxybutyrate (PHB), polysaccharides and proteins such as collagen; and metal ions.

7. The composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 for use in biomedical applications, wherein said biomedical application is preferably selected from cementum for teeth, bone, prosthesis, medical devices, drug-delivery, gene therapy and tissue regeneration.

8. Use of the composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 as electrodes.

9. Use of the composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 for doping polymers.

10. Use of the composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 as a catalyst.

11. Use according to claim 10, wherein said catalyst is a photoelectrocatalyst or an electrocatalyst.

12. Use according to claim 10 or 11, wherein said use as a catalyst is in a reaction for the synthesis of organic molecules, in particular natural amino acids.

13. Use of the composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 for adsorbing organic molecules, wherein said organic molecules are preferably selected from carbohydrates, amino acids, lipids, DNA, RNA, biopolymers selected from polylactic acid (PLA), poly lactic-co-glycolic acid (PGLA), polyhydroxybutyrate (PHB), polydioxanone (PDO), polysaccharides and proteins, and ATP.

14. Use of the composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 as a component in a solid state battery.

15. Use of the composition or material according to any of claims 5 or 6 or the polarized hydroxyapatite according to claim 1 as a component in an energy harvesting chip.