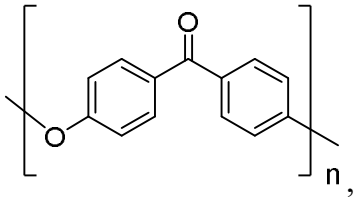
CLAIMS:

1. A poly ether ketone (PEK) dental or bone implant, wherein at least a portion of the surface of the PEK implant has a water contact angle that permits osseointegration of the PEK implant.

2. The PEK implant according to claim 1, wherein any one or more of the following apply:

(a) PEK has the following structure:



wherein n is from about 25 to about 1000;

(b) at least a portion of the surface of the implant has a roughness in the range of from about 100 nm to about 50000 nm; and/or

(c) the water contact angle is in the range of from 0° to about 20°.

3. A method of preparing a poly ether ketone (PEK) dental or bone implant, the method comprising:

(a) forming the PEK implant from PEK; and

(b) activating the PEK implant with plasma immersion ion implantation (PIII).

4. The method according to claim 3, further comprising:

(c) annealing the PEK implant, then quenching the PEK implant with a gas;

preferably wherein the annealing is performed before activating the PEK implant with PIII.

5. The method according to claim 3 or 4, wherein the PEK is in the form of a powder and/or wherein the PEK implant is formed by additive manufacturing, preferably wherein the additive manufacturing is selective laser sintering.

6. A bone implant according to claim 1 or 2 for use in repairing and/or regenerating bone tissue.

7. The bone implant for use according to claim 6, wherein the bone implant comprises a biologically active agent, preferably wherein the biologically active agent is covalently linked to at least a portion of the surface of the implant before being implanted, preferably wherein the biologically active agent is selected from the group consisting of: an antimicrobial peptide (e.g., the antimicrobial peptide Mel4), an antibacterial agent, bone cells, encapsulated bone cells, bone precursor cells, encapsulated bone precursor cells, adipose tissue derived stem cells (ADSC's), a bone morphogenic protein or other cell differentiation agent, an anticancer drug, an anticancer targeting agent, an anticancer immunotherapy agent, a membrane receptor targeting agent, vascular cells, immune cells, a calcium phosphate substrate, a calcium phosphate ceramic, periosteum, or any combination thereof.

8. The bone implant for use according to claim 6 or 7, wherein the implant comprises a hydrogel, preferably wherein the hydrogel is a cross-linked hydrogel matrix, preferably wherein the hydrogel is cross-linked gelatin methacrylate (GelMA).

9. The bone implant for use of claim 8, wherein the cross-linked hydrogel matrix comprises a cell, preferably wherein the cell is a stem cell, preferably wherein the stem cell is an adipose tissue derived stem.

10. A dental or bone implant, comprising:

(a) a PEK dental or bone implant according to claim 1 or 2; and

(b) a biologically active agent covalently linked to at least a portion of the surface of the implant, wherein the biologically active agent is selected from the group consisting of: an antimicrobial peptide, an antibacterial agent, bone cells, encapsulated bone cells, bone precursor cells, encapsulated bone precursor cells, adipose tissue derived stem cells (ADSC's), a bone morphogenic protein or other cell differentiation agent, an anticancer drug, an anticancer targeting agent, an anticancer immunotherapy agent, a membrane receptor targeting agent, vascular cells, immune cells, a calcium phosphate substrate, a calcium phosphate ceramic, periosteum, or any combination thereof.

11. A dental implant, comprising:

(a) a PEK dental implant according to claim 1 or 2; and

(b) a dental composite cement bonded to at least a portion of the surface of the dental implant.

12. The dental implant of claim 11, wherein any one or more of the following apply:

(i) the dental composite cement is covalently linked to at least a portion of the dental implant;

(ii) the dental composite forms a functional coating on the surface of the PEK implant to increase the durability of the coated surface and improve the cosmetic appearance of the surface; and/or

(iii) the implant functions as a tooth.

13. A method of increasing hydrophilicity of a poly ether ketone (PEK) dental or bone implant, comprising activating the implant with plasma immersion ion implantation (PIII), preferably wherein at least a portion of the surface of the activated implant has a water contact angle in the range of from 0° to about 20°.

14. A method of promoting bone growth, comprising:

(a) contacting the PEK implant of any one of claims 1 to 8 or 15 with at least a portion of a cross-linked hydrogel matrix comprising stem cells; and

(b) incubating the PEK implant comprising the cross-linked hydrogel matrix and stem cells under conditions that promote bone growth.

15. The method of claim 14, wherein any one of the following apply:

(i) the cross-linked hydrogel matrix is a cross-linked gelatin methacrylate matrix;

(ii) the PEK implant forms a chamber in which the cross-linked hydrogel matrix is contained;

(iii) at least a portion of the cross-linked hydrogel matrix is coupled to the PEK implant, preferably wherein the cross-linked hydrogel matrix is covalently coupled to the PEK implant; and/or

(iv) the stem cells are adipose tissue derived stem cells.