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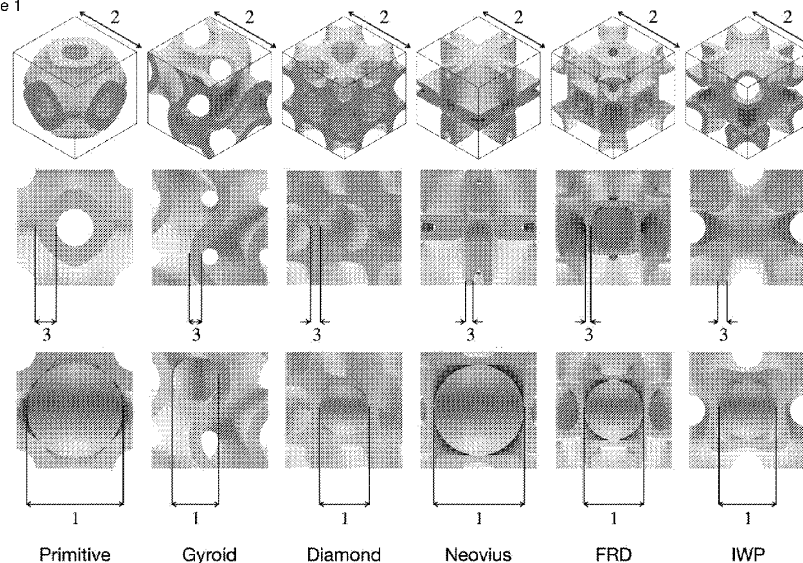
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(54) Title: POROUS-BASED BONE REPLACEMENT MATERIALS FORMED BY TRIPLY PERIODIC MINIMAL SURFACE STRUCTURE

Figure 1



(57) Abstract: Porous-based bone implants with the integration of Triply Periodic Minimal Surface, TPMS, porous architectures are designed to support the growth and proliferation of bone tissue, bone marrow, and capillaries. This disclosure intends to reduce the adverse effect of conventional implants such as bone resorption over time, which is called the "stress shielding effect". The "stress shielding effect" is caused by the mismatch between the implant and natural bone stiffness. Triply Periodic Minimal Surface, TPMS, porous architectures exhibit interconnected pore features. The interconnection of the porous network allows the TPMS to have a higher permeability than that of other porous structures, leading to more favorable nutrient transport. In addition, many physical characteristics of the TPMS structures including surface-to-volume ratio, pore size, elastic modulus, and fluid behaviors can be controlled precisely through mathematical manipulation. As a result, TPMS-based implants could be physical features, which are varied based on differ-

[Continued on next page]

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ent bone regions. In other words, the medical implants may exhibit non-uniform or gradient physical features, which can match the characteristic of trabecular and cortical bones. Therefore, TPMS-based implants could adjust the features to mimic neighboring bone regions. As a result, we can achieve medical implants, which have superior mechanical and biological responses, resulting in optimal cell growth and better medical treatment.