X-ray and neutron diffraction study of BioGlass® supported by reverse Monte Carlo modelling.

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Average life expectancy in the Western world has increased dramatically with better nutrition and improvements in medical care. To allow people to remain active, and to contribute to society for longer, the need for new materials to replace and repair worn out and damaged tissues becomes ever more important. A class of melt-quenched silicate glasses, containing calcium, phosphorus and alkali metals, and having the ability to promote bone regeneration and to fuse to living bone, creating strong implants with less danger of interfacial instability than previous materials, arose from the work of a team led by Prof. Hench. This is now produced as Bioglass® and sold under the brand names of PerioGlas®, NovaBone® and NovaBone-C/M®. [1]
The Kent team has joined a programme of study underway in the USA involving the company who own the FDA-approved BioGlass® product, which is one of very few bone-regenerative materials actually in clinical use (– the BioGlass®-based materials have been used in ~650,000 cases already). The BioGlass® family are, in essence, calcium silicate glasses with additional alkali and aklaline earth modifiers. The study of atomic-scale structure underway currently is limited to electron microscopy and IR spectroscopy, together with exploratory molecular dynamics, MD, simulation. We have collected the first high energy X-ray diffraction data and neutron diffraction data on this important material in the hope of providing more direct experimental insight into the glass structure. The experimental data has been modelled using the reverse Monte Carlo (RMC) method, primarily as an aid to the interpretation of atomic-scale structural features present in the diffraction-derived pair correlation functions.

References

[1] See www.novabone.com and www.novamin.com for commercial details.