Biomolecular systems

Bioactive glasses for promoting bone growth

LJ Skipper, FE Sowrey, DM Pickup (University of Kent), KO Drake (University of Warwick and ESRF, Grenoble), ME Smith (University of Warwick), P Saravanapavan, LL Hench (Imperial College London), RJ Newport (University of Kent) and Alex Hannon (ISIS)

With the increase in life expectancy, the need for new materials to replace and repair worn out and damaged tissues becomes ever more important. Recent work has focused on the use of the relatively low temperature sol-gel route for generating bioactive glasses, which fuse to living bone and promote bone regeneration.

The mechanism by which these materials promote bone growth has been strongly linked to evidence that the gene activation necessary for tissue regeneration is related to the release of soluble silica and calcium ions from the bioactive glass. A great deal of interest in the structure of these materials has therefore been engendered, particularly in the relationship between structure and bioactivity, and especially the nature and the role of the Ca sites within the glass network.

Using neutron diffraction with isotopic substitution, we have directly observed three Ca-O distances in a bioactive $(CaO)_x(SiO_2)_{1-x}$ sol-gel glass and quantified their respective contributions to the bonding of Ca within the silica network, providing a direct atomic-scale explanation for the empirical observation that calcium loss from these materials is facile and can be achieved by simple ion exchange with body fluid.

Why replace, when you can regenerate?!

Further information:
Prof. RJ Newport, r.j.newport@kent.ac.uk
LJ Skipper et al., J Materials Chemistry 15 (2005) 2369.