ELECTRONIC STRUCTURE OF DOPED BIOGLASS

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For decades bioglass has been used to restore bone tissue. In the manufacture of such materials, the following composition is usually used: 24,5% Na_2O, 24,5% CaO, 45% SiO_2, 6% P_2O_5 [1]. By varying the composition of the glass, one can change the properties of the material, taking into account the needs of a specific task. We have carried out doping of bioglass in order to improve the results of replacement and restoration of bone tissue elements in all branches of bone surgery at the following ratio of components, wt%: SiO_2 (33,0-47,0), CaO (10,0-27,0), Na_2O (15,0-27,0), P_2O_5 (4,0-9,0), MgO (1,0 5,0), K_2O (1,0 -5,0), CuO (0,1-3,0), Ag_2O (0,1-3,0), GeO_2 (0,1-3,0), Ga_2O_3 (0,1-3,0).

The electronic structure and structural features of doped bioglass samples were investigated using XPS and nuclear magnetic resonance.

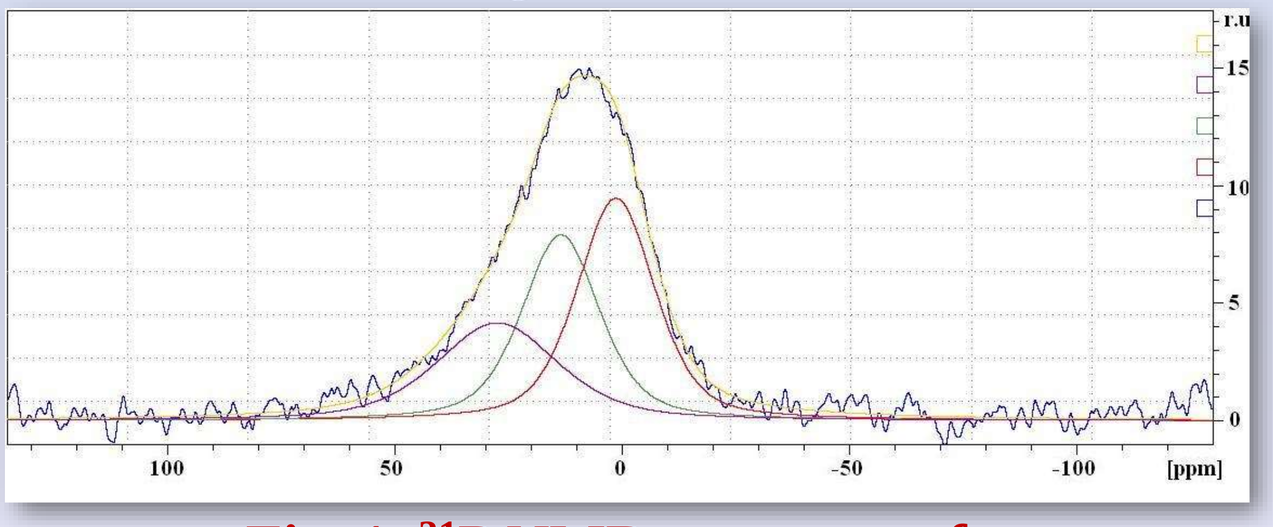

Fig. 1. ^{31}P NMR spectrum of sol-gel glass doped with Ga

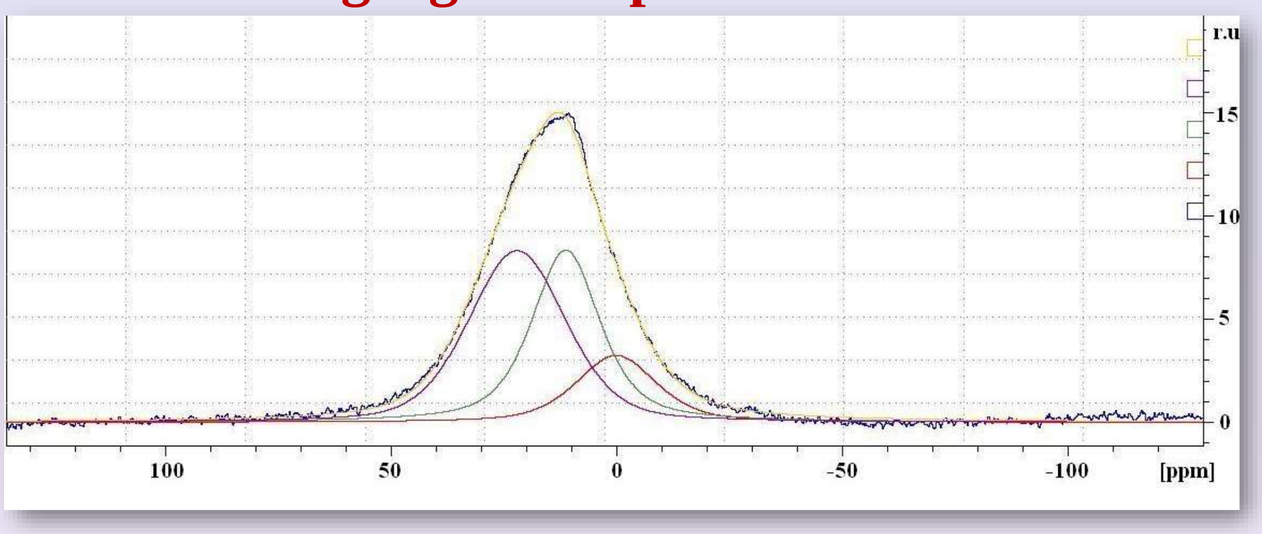

Fig. 2. ^{31}P NMR spectrum of hydrated bioactive glass

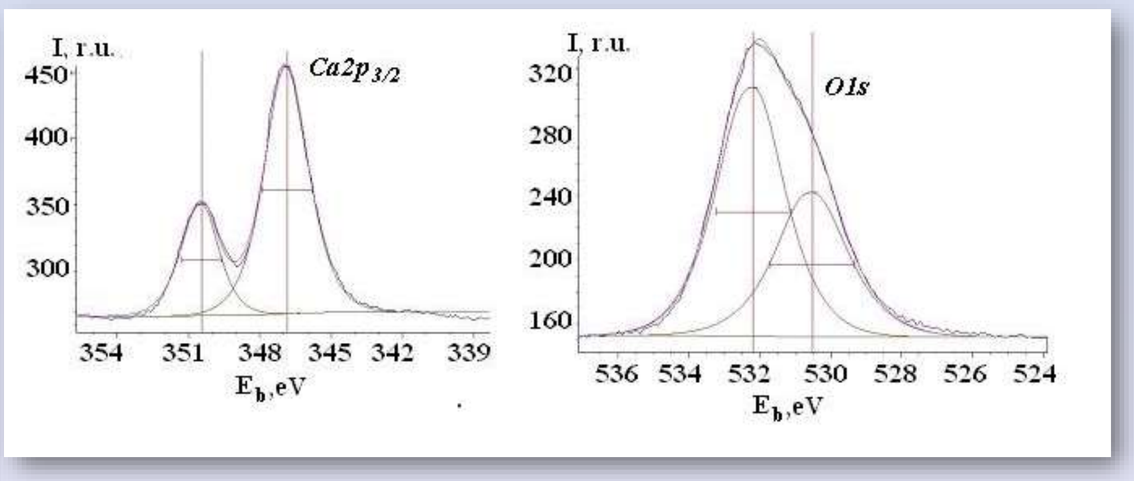

Fig. 3. XPS spectrum of Ca 2p and O 1s of sol-gel glass doped with Ga

Analysis of the XPS data indicates that depending on the conditions of glass manufacture - the rate of cooling of the melt, the temperature regime, as well as the alloying of the glass, the binding energy of the constituent elements changes.

CONCLUSIONS

NMR spectra (Fig. 1, 2), decomposed into components, have different widths depending on their ionic environment. A relatively narrow line at about 10 ppm indicates the formation of calcium hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$ in all doped bioactive glasses, regardless of the method and conditions of obtaining, but the relative proportion of calcium apatite, which is proportional to the integrated intensity of the corresponding NMR line, and its crystallinity, which is represented by the line width, significantly depend on the synthesis conditions.

REFERENCE

1. Hench L.L. Bioceramics. // J. Am. Ceram. Soc.-1998.-81. P. 1705-1728.