About Book

Abstract

During this research work, we were able to develop, by direct fusion, a set of phosphate-based oxide glasses series, for their use in various technological fields. At first, we took a particular interest in the knowledge that modifying oxides and intermediates in order to improve the performance-based oxide glasses. Studies by scanning microscopes (SEM), IR spectroscopy, X-ray diffraction of annealed glasses, and Mossbauer spectroscopy have made it possible to establish correlations between physico-chemical and structural properties. These studies have shown, in general, that when the oxygen/phosphorus ratio increases the metal/phosphorus ratio increases. The vitreous matrix undergoes significant depolymerization leading to the formation of the majority of diphosphate-type short chains with some traces of isolated orthophosphate chains. The number of metal-oxygen-phosphorus increases to the detriment of the P-O-P bond, in the vitreous network and leads to the formation of crystallites, these crystallites play an important role in improving the chemical durability and constitute a wall against corrosion. However, when the number of crystallites becomes higher, the equilibrium between the vitreous bath and the crystalline phases is no longer maintained, there is then a decrease in chemical durability. The spectra of, both, IR spectroscopy and X-ray diffraction of the annealed glasses indicate the predominance, in the glass, of isolated short orthophosphate groups. The

SEM indicates an overload of the crystallites which exceeds the vitreous phase and signals the approach of the boundary zone between the vitreous domain and the crystallized domain. On the other hand, approaching the structure of phosphate glass from the boundary zone between glass and crystal leads to the formation of a leachate, during the attack by distilled water at 90°C, with a pH suitable for the investigation of bioactive glasses. The concept of degradation of phosphate glasses makes them, in the presence of calcium oxide, useful as biomaterials and potential candidates for medical use. On the other hand, the study of electrical conductivity within phosphate binary and ternary glasses has clearly shown that approaching the vitreous structure as close as possible to the limit zone between the glass and the crystal (formation of isolated short orthophosphate groups) leads to improvement in ionic conductivity due to lattice defects, which are more numerous and in a favorable position for mobile species such as lithium.

Keywords

Phosphate glasses, Glass formation, Chemical Durability,
IR Spectroscopy, XRD, SEM, ^{57}Fe Mossbauer spectroscopy,
Nuclear and chemical wastes, Bioglasses, Bioactivity,
Electrical conductivity.