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Dissolution Kinetics of Densified Phosphate Glasses

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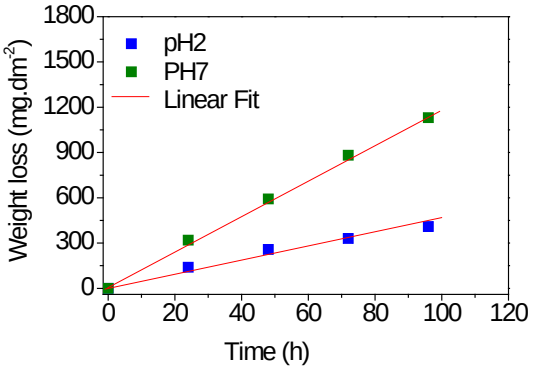
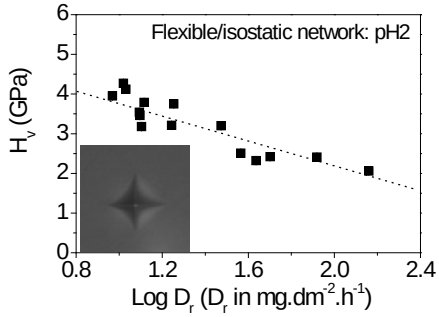
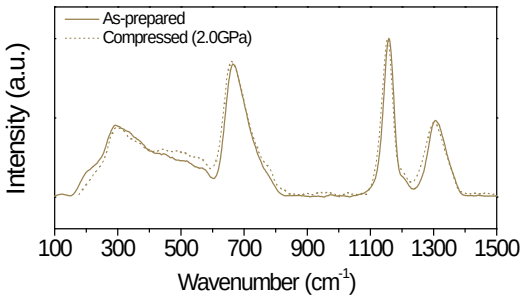
Oral

Abstract

Phosphate glasses have gained significant interest for different application during the last decades due to their properties such as low glass transition temperature (T_g). A major disadvantage of the P_2O_5 containing glasses is the low chemical durability, but this could potentially be improved by post-treating the glasses, e.g., through hot-compression. For example, in borosilicate and aluminosilicate glasses, it has been demonstrated that the hot compression improves elastic moduli and hardness. In recent studies, a direct relation has been demonstrated between the dissolution rate at various pH values and the number of chemical topological constraints per atom (n_c) acting within the molecular network. Here, we extend this work by studying the dissolution kinetics of phosphate, silicophosphate, and borophosphate glasses compressed at 0.5, 1.0 and 2.0 GPa at T_g through measurements of weight loss of bulk samples immersed in acid (pH = 2) and neutral (pH = 7) solutions. The permanently densified samples are also characterized by X-Ray Photoelectron Spectroscopy (XPS), Raman Spectroscopy, micro-indentation and Atomic Absorption Spectroscopy (AAS). We demonstrate and discuss a direct relationship between the chemical durability, mechanical properties, and the network topology as quantified through n_c.







Brief Biographical Notes

Nerea Mascaraque *is PostDoc in the Department of Chemistry and Bioscience at Aalborg University, Denmark. She graduated from Faculty of Chemistry at Universidad Autónoma de Madrid (Spain) in 2009 and received her PhD degree in materials chemistry from the same university and Ceramic and Glass Institute (ICV-CSIC) under the supervision of Dr. Francisco Munoz and Prof. Alicia Durán in 2014. Her PhD project was focused on glassy materials as solid electrolytes in all solid-state batteries (7 journal articles). Her current research focuses on atomistic design of chemically durable glasses under the supervision of Prof. Morten M. Smedskjaer (2 journal articles).*