

Raman spectroscopy study of glass alteration

MARIONA TARRAGO¹, CHARLES LE LOSQ¹, ERIC VAN HULLEBUSCH², DANIEL R. NEUVILLE¹

¹Géomatériaux, IPGP-CNRS, Université de Paris, 1 Rue Jussieu, 75005 Paris (France) tarrago@ipgp.fr

²Biogéochimie environnementale, IPGP-CNRS, Université de Paris, 1 Rue Jussieu, 75005 Paris (France)

Glass is a ubiquitous material in our daily lives. One of its most common applications is for both cookware and as a container for food and drinks (dishes, drinking glasses) where it is exposed to water and other liquids such as vinegar. The chemical composition of the glasses may contain significant concentrations of potentially toxic elements such as Ba, Co, Cr, Cu, Pb, Sb, Zn and Zr. However, an agreement on legally acceptable threshold concentrations of transition metals in glass has not been reached. Defining the maximum allowed concentrations requires an understanding of the actual migration of the PTE towards food. This study follows the alteration process of a set of industrial and natural glasses immersed in acetic acid (initial pH 2.3) at both room temperature (22°C) and 70°C (a common temperature in culinary liquids during consumption). The pH of the liquid increases during the dissolution, in particular at 70°C. The alteration of the glasses also induces structural changes that can be tracked using Raman spectroscopy. These modifications are related to the interaction between H_3O^+ , OH^- , and the silicate network regarding both the Boson peak and the polymerization at the Q^n -groups level. The presence of cations of large ionic radius (i.e. Pb^{2+}) seems to enhance the alteration.