Recent advances in the understanding of silicate glass alteration

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Understanding the dissolution of silicate glasses and minerals from atomic to macroscopic levels is a challenge with major implications in geoscience and industry. One of the main uncertainties limiting the development of predictive models lies in the formation of an amorphous silica rich surface layer —called gel— that can in some circumstances control the reactivity of the buried interface.

Within the frame of the EFRC WastePD project, teams from various fields gather their efforts to better understand the basic mechanisms of materials corrosion, including waste glasses, ceramics and metals. The use of advanced experimental and simulation methods allowed us to better understand the dynamics of gel formation, linking the glass structure to that of the gel and to the mobility of water and ions in the nanopores left by the release of mobile species and the reorganisation of the silicate network [1-3].

Slight compositional variations may dramatically affect glass dissolution rate. In dilute conditions, powerful models can now explain the effect glass composition on the forward rate relying on new structural descriptors [4]. However the effects of glass composition on the gel properties and on the resulting residual rate remain poorly understood.

Lastly, interactions between solids, for instance glass and metal, are also under investigation. We show how both glass alteration and crevice corrosion are enhanced when a piece of borosilicate glass in placed in contact with stainless steel in a NaCl solution, a phenomenon neglected until now.

[1] Gin (2018) *Nat. Comms.* **9**, 2169 [2] Collin (2018) *npj Mat.Deg.* **2**, 1-22 [3] Collin (2018) *J. Phys. Chem. C* **122**, 17764-17776. [4] Lu (2019) *J. Phys. Chem. B* **123**, 1412-1422.