

Influence of Calcium on the Dissolution Behaviour of Sodium Aluminosilicate Glasses

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The dissolution kinetics of $(1-x)\text{SiO}_2-x\text{CaO}-25\text{Na}_2\text{O}-5\text{Al}_2\text{O}_3$ glass (where x ranges from 0 to 25 in steps of 5) are described in aqueous solutions buffered to pH 7 at 90°C. The alteration solutions were analysed over a 4-day period, and the proton consumption was monitored for 3 hours at the same temperature and pH. Resonant nuclear reaction (RNR) and elastic recoil detection (ERD) analyses with energetic ion beams have been used to study hydration and ion exchange processes by measuring the hydrogen and sodium ($^{23}\text{Na}[p,\alpha]^{20}\text{Ne}$) profiles of leached glasses. The interdiffusion mechanism between protons, molecular

water and sodium is closely connected to the glass composition. The hydrated layers were also characterised by scanning electron microscopy, which corroborated the solution analysis results indicating a threshold effect with minimal alteration for about 15% of CaO. Moreover, a slowdown of diffusive phenomena is observed with the increase of calcium content in the glass. Raman spectroscopy has been used to investigate the pristine glass structure. The increased glass alteration above and below this threshold is discussed according to the degree of network polymerisation and calcium position.