

Hydration in Alkali-silicate Glasses Studied by Two Dimensional Multi-Quantum Magic Angle Spinning

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The hydration in Na₂O-3SiO₂ glass was studied by ²³Na Magic Angle Spinning (MAS) and 2D MQMAS NMR spectroscopy. It was found that one-dimensional MAS spectra for the hydrated glasses with more than 8.4 wt% water consist of two signals at around –10 and –40 ppm. On the other hand, anhydrous glass and glass with low water content (2.8 wt%) give a single resonance line at around –10 ppm. From 2D MQMAS spectra, the isotropic chemical shift (δ_{iso}) and the quadrupole coupling frequency (ν_Q) for two sites (Na(1) and Na(2)) were estimated: $\delta_{\text{iso}} = 4.2$ ppm and $\nu_Q = 0.6$ MHz for Na(1) and $\delta_{\text{iso}} = 10.2$ ppm and $\nu_Q = 1.3$ MHz for Na(2). These results are discussed together with our previous results of ²⁹Si and ¹H NMR, and infrared spectra. It is speculated that Na(1) may exist in a similar environment as that in anhydrous sodium-silicate glasses, while Na(2) may be attached directly to water molecules.

Key words: Glass; Hydration; ²³ Na; 2D MQMAS.