

**AMORPHOUS MATERIALS: PROPERTIES, STRUCTURE, AND DURABILITY†**

**Structure of Mg- and Mg/Ca aluminosilicate glasses:  $^{27}\text{Al}$  NMR and Raman spectroscopy investigations**

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**ABSTRACT**

The structure and properties of glasses and melts in the  $\text{MgO-Al}_2\text{O}_3\text{-SiO}_2$  (MAS) and  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$  (CMAS) systems play an important role in Earth and material sciences. Aluminum has a crucial influence in these systems, and its environment is still questioned. In this paper, we present new results using Raman spectroscopy and  $^{27}\text{Al}$  nuclear magnetic resonance on MAS and CMAS glasses. We propose an Al/Si tetrahedral distribution in the glass network in different  $Q^n$  species for silicon and essentially in  $Q^4$  and  $^{\text{VI}}\text{Al}$  for aluminum. For the CMAS glasses, an increase of  $^{\text{VI}}\text{Al}$  and  $^{\text{VI}}\text{Al}$  is clearly visible as a function of the increase of Mg/Ca ratio in the  $(\text{Ca,Mg})_3\text{Al}_2\text{Si}_3\text{O}_{12}$  (garnet) and  $(\text{Ca,Mg})\text{AlSi}_2\text{O}_8$  (anorthite) glass compositions. In the MAS system, the proportion of  $^{\text{VI}}\text{Al}$  and  $^{\text{VI}}\text{Al}$  increases with decreasing  $\text{SiO}_2$  and, similarly with calcium aluminosilicate glasses, the maximum of  $^{\text{VI}}\text{Al}$  is located in the center of the ternary system.

**Keywords:** Aluminosilicate, glasses, NMR, Raman