Abstract

This study investigates how the composition of calcined clays influences phase formation and the flexural strength of autoclaved fiber cement. X-ray diffraction (XRD), scanning electron microscopy/energy-dispersive X-ray spectroscopy (SEM/EDS) and thermogravimetric analysis (TGA) reveal that reactive Al_2O_3 from calcined clay promotes the formation of aluminum-substituted tobermorite during hydrothermal curing, thereby increasing flexural strength. The degree of aluminum incorporation into Al-tobermorite correlates positively with the reactive Al_2O_3 content of the calcined clay. However, excessive reactive Al_2O_3 hinders Al-tobermorite formation, leaving clinker phases dehydrated and leading to a marked reduction in flexural strength.

These findings indicate that calcined clays derived from low-kaolinite sources which contain more quartz and less reactive Al_2O_3, can be used at higher replacement levels in autoclaved systems. In contrast, clays with high reactive Al_2O_3 content should be used cautiously, as excessive incorporation impairs Al-tobermorite formation and consequently reduces flexural strength. Therefore, from the perspective of performance, cost, and availability, low-kaolinite calcined clays are the preferred choice.