
Abstract

Fiber segregation is a critical issue in fiber cement composites, as it promotes anisotropic behaviour and compromises the mechanical reliability of the material. This study investigated the effects of fiber segregation and anionic flocculant addition on the physical and mechanical performance of Basic Magnesium Sulphate Cement (BMSC) composites reinforced with short, recycled textile fibers. Composites containing 8%, 10%, and 12% fiber by volume fractions were produced and mechanically evaluated under two loading positions associated with segregation: fibers at the top (F-TOP) and fibers at the bottom (F-BOT). The results demonstrated that segregation significantly affected the modulus of rupture (MOR), limit of proportionality (LOP), and specific energy (EE), with higher mechanical performance observed when fibers were positioned in the tensile zone (F-BOT position). For instance, the MOR increased by up to 87% from F-TOP to F-BOT in composites with 8% fibers, demonstrating the strong dependence of flexural behaviour on fiber distribution. The addition of flocculant progressively reduced the segregation of fibers and fine particles, leading to a more homogeneous microstructure and decreasing the mechanical differences between upper and bottom positions. As segregation decreased, MOR, LOP, modulus of elasticity (MOE), and EE values became more stable and converged toward intermediate values between F-TOP and F-BOT. Furthermore, increasing the fiber content from 10% to 12% further enhanced this homogenization effect, suggesting that a denser fiber network improves stress transfer and reduces position-dependent behaviour. The combined effect of increased fiber content and flocculant addition significantly reduced mechanical anisotropy and promoted a more homogeneous board formation in the BMSC fiber-cement composites.
