2024년 춘계학술발표대회 : 일반부문

플라이애시와 팽창유리 골재를 혼합한 경량 탄소 TRM의 인장 성능

Tensile performance of lightweight carbon TRM incorporating fly ash and expanded glass aggregates

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키워드 : 인장거동, 경량 모르타르, 탄소섬유, 플라이애시.
Keywords : Tensile behavior, lightweight green mortar, carbon textile, fly ash.

Textile-reinforced mortar (TRM) has emerged as an innovative composite material, gaining prominence as a viable alternative to traditional fiber-reinforced polymers. Recent scholarly investigations have focused on understanding the mechanical properties and sustainability aspects of TRM, with a particular emphasis on addressing environmental concerns. Notable strategies from research include the substitution of cement with supplementary materials and the incorporation of lightweight aggregates to reduce overall density. This present study aims to explore the efficacy of a sustainably designed carbon TRM, achieved by incorporating lightweight expanded glass aggregates and fly ash as partial replacements for cement.

Commercially available fabrics comprising carbon yarns in two perpendicular orientations were employed. The experimental test setup was in accordance with the specifications outlined by RILEM TC 232-TDT. Each test specimen was securely clamped between two steel plates and fastened with six bolts at each end. Uniaxial tensile loading was applied at a controlled strain rate of 0.3 mm/min.

Fig. 1 demonstrates the typical tensile stress-strain curves of lightweight TRM specimens with various amount of fly ash used as partial substitute for cement. Cement replacement with FA at a reasonable concentration (30% or less) revealed negligible differences in TRM's tensile performance. In particular, the crack stress and peak stress capacity of TRM showed a modest augmentation with a 30% FA substitution. But when the replacement content approached 50%, there was a noticeable decrease in tensile strength.

The application of expanded glass aggregate with 0.5 mm and 1.0 mm maximum diameters showed negligible variation in TRM's tensile performance. But there was a noticeable reduction when expanded glass aggregate with a 2 mm maximum size was used.

Regardless of the fabric reinforcement ratio employed, the tensile performance of the TRM was considerably improved by the incorporation of short nylon fibers dispersed throughout the matrix, both before and after cracking stage.

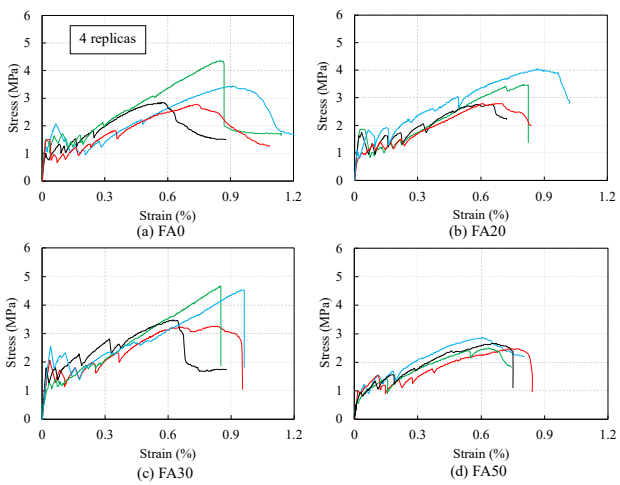

Figure 1. Tensile stress-strain curves in the FA series

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본 연구는 한국연구재단 대학중점연구소지원사업의 연구비 지원(2020R1A6A1A03044977)의 연구비 지원으로 수행되었으며, 이에 감사드립니다.