INVESTIGATION OF THE PIEZORESISTIVE BEHAVIOR AND FLEXURAL STRENGTH OF GRAPHENE-MODIFIED CONCRETE

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One of the modern structural health monitoring techniques that has been receiving the attention of various researchers is the use of electrically conductive cement-based composites which exhibit piezoresistive behavior. This study focuses on incorporating graphene nanoplatelets (GNPs) as conductive fillers to make a self-sensing concrete. It aims to determine the effects of varying amounts of GNP on the piezoresistive behavior and flexural strength of concrete. A total of 21 specimens were made – three experimental groups with 6 specimens each, and a control group with 3 specimens. Type 10 solid copper wires spaced at 1in. intervals were embedded along the length of each beam to allow the measurement of electrical resistance. All specimens were cured in lime-saturated solution for 28 days, then air-dried until a constant weight was obtained. The flexural strength test was performed via third-point loading while the four-point probe test was conducted using a microcontroller board that is programmed to measure resistance continuously during loading. An increase in flexural strength up to 65.21% was observed in the experimental group with 0.0514% GNP concentration. This is attributed to the high tensile strength of GNP that prevents the formation and propagation of cracks. Furthermore, the plots of electrical resistance along the length of the GNP-modified beams, which show significant increase in resistance at point of failure, illustrate the damage-sensing capabilities of GNP-modified concrete.