Thermal Behavior of Modified Cementitious Composites Under Simulated Wildfire Exposure

Siddiqui, Deeba (School: Santiago High School)
Jamal, Filza (School: Santiago High School)

In early January 2025, a series of wildfires spread across Los Angeles, devastating houses and forcing multiple families to evacuate their homes. These fires included the Sunset Fire, Palisades Fire, and Eaton Fire. These tragedies revealed the severe need for refined fire-resistant construction materials. This experiment determined whether adding fire-resistant additives to the standard stucco used in modern infrastructure would improve its durability in terms of visual damage and heat transfer. The five mixtures tested include: standard stucco (control), perlite stucco, vermiculite stucco, concrete bonding solution stucco, and fiberglass stucco. The methodology contained two parts. Part 1 involved simulating a realistic wildfire using a bonfire. The stucco bricks were exposed to the bonfire for 5 minutes, subjected to intense thermal radiation across a wide surface area. After their removal, the temperature was measured on both the front and back sides with a thermal. The front is defined as the side directly exposed to the heat source, while the back refers to the opposing side. In Part 2, the stucco bricks were exposed to a propane torch flame to assess durability under controlled conditions. This heat was applied at the center of each sample, allowing for uniformity and reduction of confounding variables. The front and back side temperatures were measured after 1, 3, and 5 minutes of controlled heat exposure. By comparing the heat transfer, temperature gradient, rate of heat penetration, heat absorption, thermal resistance index, physical damage, and the percent improvement over control of all the stucco mixtures, it can be concluded that all the stucco fire-resistant additives improved some aspect of the heat resistance of the standard stucco formula.

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