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ENAMEL COATING FOR STEEL REBAR IN CONCRETE: CORROSION BARRIER AND BOND ENHANCER

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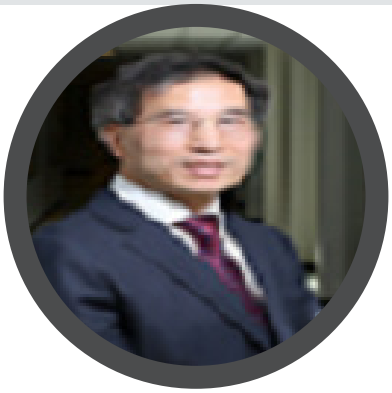
This paper summarizes the corrosion resistance and bond strength of coated and uncoated steel reinforcing bars in mortar or concrete. Coatings investigated included pure enamel (PE) for corrosion protection, calcium silicate modified enamel (ME) for bond enhancement, and double enamel (DE) with an inner layer of PE and an outer layer of ME. For comparison, fusion-bonded epoxy (EP) was also considered. For corrosion performance, mortar cylinders reinforced with uncoated (UN) and PE-, ME-, DE-, and EP- coated steel bars were immersed and tested in 3.5 wt% NaCl solution. The corrosion evolution was monitored using electrochemical impedance spectroscopy (EIS). The increase in corrosion resistance was as high as 100 times and 4 times when the steel bar was coated with PE and ME, respectively. Due to chemical bond between the enamel and steel, the corrosion of damaged PE-coated bars was confined to damage areas with no under-film corrosion as observed with EP coating. For bond behaviour, pull out specimens were prepared with one steel bar placed along the center line of each mortar cylinder. The effects of mortar curing time (28 days and 60 days) were investigated. The PE-coated steel bars were also tested in large-scale reinforced concrete (RC) columns under cyclic loads and in full-scale RC walls under blast loads to understand how the bond improvement of enamel coating at material level was translated to the performance of structural systems. The bond strength can be increased by 2 times and 7 times when a steel bar is coated with PE and ME, respectively. The significant steel-concrete bond increase with ME resulted from the increased surface roughness and the chemical bonding of embedded calcium silicate particles in surrounding mortar. With enamel coating, the failure modes of RC columns and walls can be changed from brittle to more ductile behaviour.



Biography

Genda Chen has received his PhD in Civil Engineering at State University of New York at Buffalo. He is Professor and Robert W Abbett Distinguished Chair in Civil Engineering, and Director of the federal-funded, five-year INSPIRE University Transportation Center at Missouri University of Science and Technology. He is an Associate Director of the federal-funded, five-year Mid-America Transportation Center headquartered at the University of Nebraska, Lincoln. He has published more than 150 papers in reputed journals in the field of interface mechanics and deterioration, structural health monitoring, structural control, and multi-hazard assessment and mitigation. He has been serving as an Associate Editor of the *Journal of Civil Structural Health Monitoring*, a section Editor of *Sensor*, and an Editorial Board Member of 5 reputed journals.

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