Galvanized Reinforcing Steel and Sacrificial Anode Cathodic Protection to Prevent Corrosion of Reinforced Concrete Structure

Pakawat Sancharoen[a,*], Melati Sari Dewi[a], Mengty Toeng[a], Adithep Bunphot[a], Pitichon Klomjit[b], and Somnuk Tangtermsirikul[a]

[a] *Sirindhorn International Institute of Technology, Thammasat University, Klong Luang, Pathum Thani, 12120, Thailand*

[b] *National Metal and Materials Technology Center (MTEC), Klong Luang, Pathum Thani, 12120, Thailand*

*pakawat@siit.tu.ac.th

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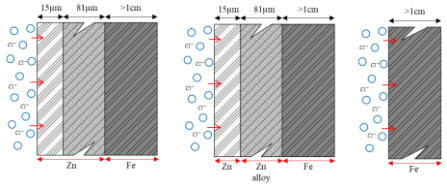
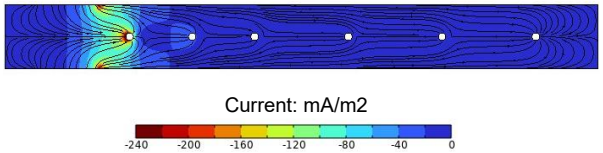
Corrosion of reinforcing steel adversely affects service life and maintenance cost of reinforced concrete structures especially in chloride rich environment. Hot dip galvanized (HDG) reinforcing steel is one of alternative reinforcing bars that show better resistance against corrosion due to chloride. This paper shows results of corrosion rate and service life of uncoated, corroded HDG and uncorroded HDG reinforcing steel. Moreover, bond strength of reinforcing steel and concrete is also studied. Different binders including hydraulic cement, coal fly ash and calcined clay are used as a binder of concrete. Different chloride contents are mixed initially into concrete to initiate different severity of reinforcing steel corrosion. The results show that corrosion current of uncorroded HDG is the lowest. And corrosion rate of corroded HDG is increased and comparable to uncoated steel due to zinc alloy layer is exposed. However, calculated corrosion cracking time of concrete using HDG reinforcing steel both corroded and uncorroded is longer than uncoated steel. Initial bond strength of HDG reinforcing steel is significantly reduced due to hydrogen evolution and should be concerned. Chromate treatment is recommended to minimize hydrogen evolution. Moreover, quality control of HDG thickness and zinc composition are very important for a good corrosion resistance. Also zinc sacrificial anode cathodic protection is widely used in corrosion damages repair work. Performance of embedded zinc anode and zinc tape anode is studied and compared. Different chloride contents are mixed initially to concrete to initiate reinforcing steel corrosion. Reinforcing steel is embedded 10cm to 75cm distance from anode. Potential decay shift results show that both embedded zinc and zinc tape can protect corrosion of reinforcing steel. However, corrosion properties such as potential and current flow of zinc anode and reinforcing steel significantly change in the long term due to many causes. Deterioration of anode and re-passivation of reinforcing steel are needed to be further studied to accurately predict service life of sacrificial anode protection system.

Graphical Abstract (mandatory)



Corrosion of HDG reinforcing steel



Current distribution of zinc sacrificial anode