混凝土中骨材與水泥漿界面處過渡區性質與耐久性之研究

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摘要

本研究主要是觀測常溫濕拌 HPC 試體在飽和石灰水與飽和硫酸鈉溶液養護及加速劣化下對骨材介面處過渡區的影響，由 SEM 觀測下可發現，常溫濕拌混凝土在飽和石灰水養護下，其初期水化過程中，水泥漿與骨材間之 100μm 範圍內，其孔隙與水化產物呈現出一間歇交錯狀，隨齡期之增加孔隙之分佈由初期水化時的大型塊狀、條狀分佈，漸成不定形的小型塊狀組織，且在水泥漿與骨材間之 100μm 範圍間發現 56 天齡期之孔隙大部份集中在距骨材邊緣 0~15μm 之間，其水化生成物之結實程度在任何齡期下均隨著距骨材界面距離之增加而更緻密。另外比較飽和硫酸鈉溶液養護之情況，在飽和石灰水養護下 7 天時可發現有 AFm 產生，但在飽和硫酸鈉養護下則需 14 天才發現。在飽和石灰水養護下，14 天之孔隙形狀已呈現類似條狀的分佈，在 28 天及 56 天齡期時，其孔隙的形狀已呈現網狀結構的分佈。而在飽和硫酸鈉養護下 28 天的孔隙形狀才呈現類似條狀的分佈。由 14 天齡期之加速劣化試驗的 SEM 觀測結果發現，經 15 次加速劣化後之 C-S-H 水化生成物，存在有許多孔隙。由骨材與水泥漿之交互作用試驗結果發現，骨材並不會與水泥漿產生交互作用而生成水化產物，故對骨材與水泥漿之界面粘著力之影響僅由水化產物來控制，由於靠近骨材界面處之水化產物以 AFm 為主且 CH 量不足以使飛灰產生卜作嵐反應，雖然 gel 之表面粘著力高於 AFm，即使如此，表面粘著力仍小於聚族的強度。而添加卜作嵐材料之高性能混凝土雖然無法有效改善骨材界面處之粘結力，但因卜作嵐反應能有效提高過渡區的強度，故有添加卜作嵐材料之高性能混凝土之整體強度仍然優於傳統混凝土。

關鍵詞：高性能混凝土、過渡區、交互作用、水膠比、水化產物、加速劣化

Study of the properties of Interfacial Transition Zone and the Durability of Concrete

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Abstract

This research is to investigate the Interfacial Transition Zone (ITZ) of Wet Mixed high performance concrete curing in lime water or sodium sulfate solution to get accelerate inferior test. From SEM(Scanning Electron Microscope), Wet Mixed concrete curing in lime water, it was found that the pores and hydration products at the Interfacial Transition Zone within 100 μm between paste and aggregate were permuted each other during the early hydration stage and then appeared as large lump or strip. They gradually became irregular and small lump for the further curing age. At the 56 days curing age, pores almost concentrated within an area of 0-15 μm from the aggregate edge. The hydration products were much denser with the increase of its distance from aggregate edge. Further, to compare the situation of curing in sodium sulfate solution, we find the hydration products AFm appeared in the sample at 7 days age curing in lime water, but it appeared at 14 days age in the sample curing in sodium sulfate. The pore shape of 14 days curing in lime water, appeared a mesh distribution, but the same pore shape was appeared at 28 days age curing in sodium sulfate. From SEM of accelerate inferior test at 14 days, the C-S-H products after 15 times accelerate inferior test that existed more pores. From the result of interaction test, we found that aggregate and paste not appeared interaction, so that, the bond strength of aggregate and paste was control by hydration products only. We find the hydration products AFm was appeared on aggregate edge and amount of CH was not enough let fly-ash to progress Pozzolanic reaction. Although, add Pozzolanic material can not to improve the bond strength of interface, but Pozzolanic reaction can improve compressive strength of ITZ, so that, the full strength of HPC was larger than traditional concrete.

Keywords：High Performance Concrete； Interfacial Transition Zone；Interaction； Water-to-binder ratio； Hydration products；Accelerate Inferior