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越南粉煤灰对混凝土的物理性能、耐久性和钢铁腐蚀概率的影响

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摘　要：越南粉煤灰以 10%、20%和 40%的比例作为普通硅酸盐水泥的部分替代品，而三组的水胶比分别保持在 0.42、0.5 和 0.55。所有混合物的抗压强度被测定到 90 天。粉煤灰混凝土的耐酸性通过浸泡在 10% H2SO4 溶液中的 100×100×100mm3 立方体的质量损失和抗压强度损失来检验。通过测量尺寸为 100×100×500mm3 的梁内钢筋的半电池电位来评估粉煤灰混凝土中钢筋的腐蚀概率，并确定这些梁在 5%的氯化钠溶液中浸泡 300 天后的抗弯强度。结果表明，粉煤灰混凝土的抗压强度在早期阶段会降低，但随着混凝土继续水化而增加。粉煤灰增加了混凝土的耐硫酸性。粉煤灰的添加对减少混凝土中钢材腐蚀概率的风险只有有限的作用。在 5%的氯化钠溶液中浸泡 300 天后，10%和 20%的粉煤灰加固的混凝土梁的承载力要高于对照组。
关键词：混凝土；粉煤灰；工作性；抗压强度

Effect of Vietnamese Fly Ash on Selected Physical Properties, Durability and Probability of Corrosion of Steel in Concrete

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Abstract　Vietnamese fly ash was used as a partial replacement for ordinary Portland cement in the proportions of 10%, 20% and 40%, while the water to cementitious ratios were kept constant at 0.42, 0.5 and 0.55, respectively, for three groups. The compressive strengths of all mixes were determined up to 90 days. The acid resistance of fly ash concrete was examined by the mass loss and compressive strength loss of 100 × 100 × 100 mm3 cubes immersed in a 10% H2SO4 solution. The probability of steel corrosion in the fly ash concrete was assessed by measuring the half-cell potentials of steel bars within beams dimensions of 100 × 100 × 500 mm3, and the flexural strengths of these beams after 300 days of immersion in a 5% NaCl solution were determined. The results demonstrate that the compressive strength of fly ash concrete is reduced at an early age but increases as the concrete continues to hydrate. The fly ash increases the sulfuric acid resistance of concrete. Fly ash additions have only a limited effect on reducing the risk of probability of corrosion of steel in the concrete. The load capacities of 10% and 20% fly ash reinforced concrete beams are higher than that of the control beams after 300 days immersed in a 5% NaCl solution.
Keywords　Concrete; Fly ash; Workability; Compressive strength

1.引言

1920

6　　FA　　5

75-80%

ASTM C618

3%　　F

57%　　16%　　C　F　　1%-12%

C

30%-40% F C
C
SO4 2- F
CAN/CSA A3001-03

Na2O K2O SO3

SCM

SCM

50

Prudential
1955
60,000
3,000 OPC

C3S 3CaO SiO2 C2S 2CaO
SiO2 C3A 3CaO Al2O3
C4AF 4CaO Al2O3 Fe2O3
CSH
CSH

C
F

OPC
0% 10% 20% 40% W-CM
0.42 0.50 0.55

2.材料

Song
Gianh Pha Lai
ASTM F

3.混合物比例和试样

4 W-CM
0.42 M2 M3 M4 OPC 10%
20% 40% M1
4 W-CM
0.5 M6 M7 M8 OPC 10%
20% 40% M5
3 4 W-CM
0.55 M10 M11 M12 OPC 10%
20% 40% M9

4.测试方法

4.1

BS EN 12390-3:2009
- 3
18 100×100×100mm3
1 7 14 28 56 90
27◦C

4.2

ASTM C267

6 100 × 100 × 100 mm3 3
10% H2SO4
90 10%
98%
10%

20 10%

10% 90

4.3.

12 100×100mm2 500mm
8mm 250
250MPa 15mm
28 5%
/
5%
301
ASTM C876

Ag/AgCl/0.5M KCl ASTM C876
Ag/AgCl/0.5 M KCl -100 -250 mV

-100 mV Ag/AgCl/0.5 M KCl
10% -
250 mV
90%

5 结果和讨论

5.1

1 W-
CM=0.42 40%
3 5.5
2 W-CM=0.5 7
20 3 W-CM=0.55 10 29

5.2

90

W-CM
0% 90

W-CM M3 20%
W-CM=0.42 56
M1 0% W-CM=0.42
10% W-CM 0.5 28
3 W-CM=0.55
90

5.3

10% 90

10%
M4 40%
W-CM=0.42 M8 40% W-CM=0.5
M4
M8
M7 20% W-CM=0.5 M11 20 W-
CM=0.55

W-CM=0.42
0% 10% 20% 40%
11.4% 6.0% 6.9% 1.5% W-CM=0.5
0% 10% 20% 40%
9.3% 6.7% 6.6% 0.4% W-CM=0.55 0%
10% 20% 40%
6.1% 4.4% 1.3% 0.4%

W-CM
0%
W-CM 0.42 0.5 0.55
11.4% 9.3% 6.1%
10% W-CM 0.42 0.5 0.55
6% 6.7% 4.4% 20%
W-CM 0.42 0.5 0.55
6.9% 6.6% 1.3%
40% W-CM 0.42 0.5 0.55
1.5% 0.4% 0.4%

5.4

-150 mV Ag/AgCl/0.5M KCl
-400 mV Ag/AgCl/0.5M KCl
1 W-CM = 0.42 10%
20% 40% 0%

W-CM=0.42 10%FA
2 W-CM=0.5 10%

20% 40%
0%
W-CM=0.55 3
10% 20%
40% 0%
: 5% NaCl
301
1 0%
21
10% 20% 40%
15.5 16.6 16.3
21.55 10% 20% 40%
16.23 18.9 17.08
90
5% NaCl
300

6.结论

6.1

-

-
10% 40%
W-CM
28 56
0%
-
10% 40%
20%
-

0.42 0.5 0.55

-
10%

-
10% 20%
5%
300

-
5% 15% 25% 30% 35%

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