HIGH-PERFORMANCE WATERBORNE EPOXY FORMULATION FOR SELF-LEVELING CEMENTITIOUS COATING FOR CONCRETE

Self-leveling overlay systems for concrete floors offer numerous benefits. They can correct uneven floors, repair damaged concrete, and provide a smooth and durable new surface for decorative and functional treatments. Non-modified cement-based overlays typically used for this application can provide durability, long life, and low-maintenance cost coatings. Some of their disadvantages, however, include delayed hardening, low tensile strength, poor thermal shock and low chemical resistance. To mitigate these disadvantages, the cement can be modified with various types of organic polymers. One such advanced composition is an epoxy modified cement (EMC), using Evonik's waterborne epoxy thermoset technology based on Anquamine® 287 curing agent and an epoxy resin.

Anquamine® 287-based EMC has a low odor and can be formulated free of volatile organic compounds (VOC), thus allowing for application in areas such as schools, offices or hospitals, that need to remain occupied during application.

Table 1
Epoxy-modified cement formulation based on Anquamine® 287 curing agent and epoxy resin.

3K-Formulation	Components	Parts
Part A	Liquid epoxy resin/emulsion	5 - 15
	Defoamer	0.05 - 0.10
Part B	Anquamine® 287	17.0
	Water	0 -10
Part C	Portland cement	15 - 35
	Quartz sand (various particle size)	15 - 35
	Superplasticizer (powder)	0 - 0.20

A typical 3-component cementitious concrete formulation based on Anquamine® 287 is shown in Table 1. The extensive latitude with varying the binder levels in the formulation provides flexibility in tailoring the performance properties in terms of cure speed, thermal properties, chemical resistance, and tensile strength. Evonik's EMC formulation using Anquamine® 287 shows significant performance benefits over standard polymer modified cements (PMC), including a much higher compressive strength and better adhesion to concrete (Table 2).

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Table 2
Epoxy modified cementitious coating (5% binder content) vs. commercial polymer modified cement self-leveler coatings.

Test item (22 /50% RH)		Commercial PMC self-leveler (1)	Commercial PMC self-leveler (2)	EMC 5% organic binder
Bond strength to concrete (ASTM D7234), 7d		502 psi (coating failure)	552 psi (concrete failure)	651 psi (Cohesive failure)
Compressive strength – psi (ASTM C579)	1 day	942	2,859	1,678
	3 days	1,105	3,144	6,700
	7 days	1,246	3,146	10,200
	28 days	2,214	5,037	13,600
Tensile strength (ASTM C307), 28d - psi		114	398	1,005
Flexural (ASTM C580), 28d - psi		311	1,145	2,337
Impact resistance (ASTM D7294) (In.lbs)		140	140	90
Abrasion resistance (ASTM D6037) (mg)		> 500	> 500	300