





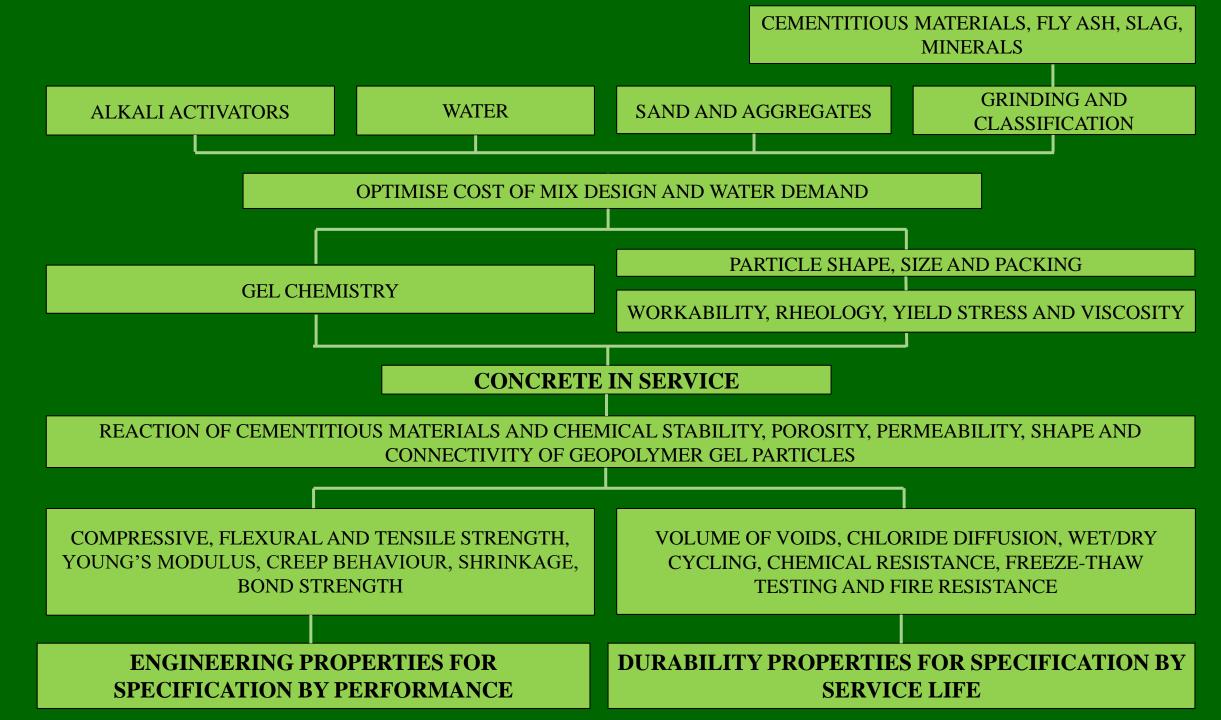
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DuRSAAM Green Concrete for Sustainability

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PARAMETERS AFFECTING SETTING TIME

Fly ash pH value

- pH > 11 flash-setting (5 minutes after mixing)
- 8 < pH < 11 rapid setting
- pH < 8 optimal value

CaO content

• CaO content can affect the pH of fly ash and influence the setting time

Sodium silicate/Sodium hydroxide (S/N)

• A higher content of silicates increases the setting time

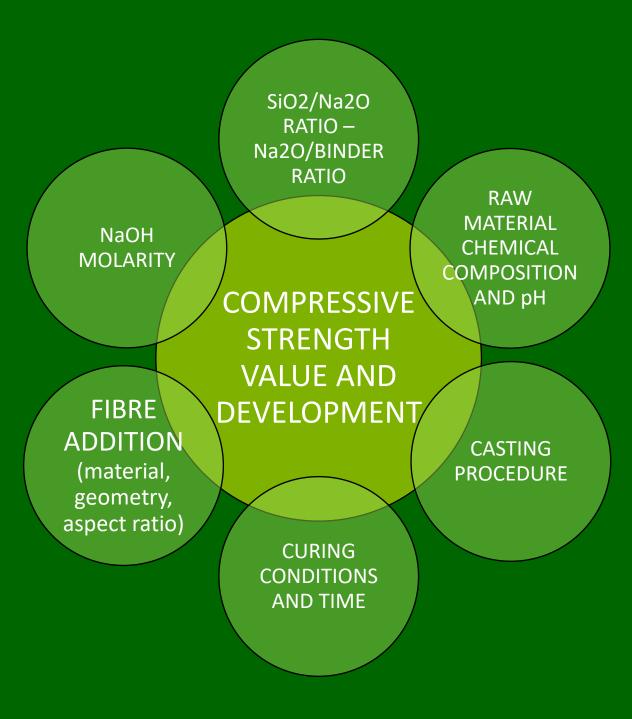
Temperature

- Heat development due to the addition of the solution in the mixing phase can lead to rapid setting
- Pre-mixing the activators (24 hours) before the casting help to reduce the mix temperature and to prevent fast setting

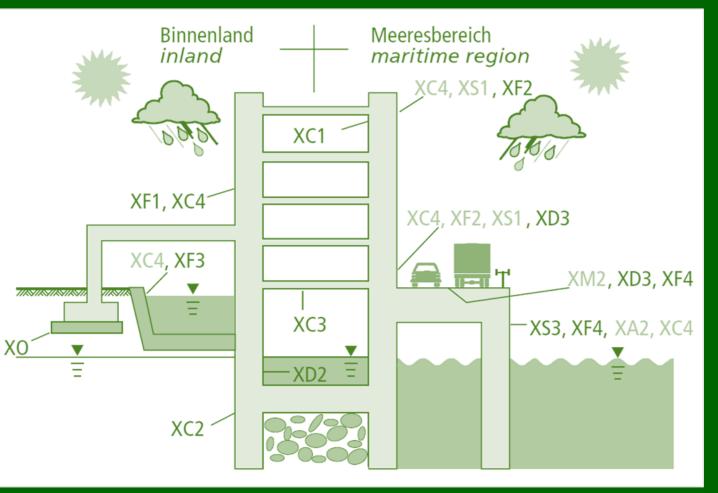
Absence of suitable admixture for AAMs

• Admixture used in OPC-based concrete as retarder (to increase the initial setting time) behave differently in AAMs, especially in low-CaO content systems





Expositionsklassen (Umwelteinwirkungen, "Angriffe") Exposure classes (environmental effects, "attacks")					Betontechnische Maßnahmen ("Widerstände") Concrete technology measures ("resistances")				
Klassenbez. Ei class ef designation		Einwirkung und Beanspruchung effect and stress		Max. w/z max. w/c		Min. z min. c		f _{ck} , cube f _{ck} , cube	
хо		\square	kein Betonangriff	keine Anforderung no requirement		keine Anforderu	ing	C8/10	
		kein Angriff no attack	no concrete attack			no requirement		C8/10	
хс	1	+ ^{H,O} + + € co,	trocken <i>dry</i>	0,	,75	240		C16/20	
	2		ständig nass constantly wet	0,75		240		C16/20	
	3		mäßig feucht moderately moist	0,6	5	260		C20/25	
	4	Carbonatisierung carbonation	wet / dry	0,60)	280		C25/30	
XD/ XS	1	¹ □ ¹ ¹	mäßig feucht moderately moist	0,55		300		C30/37	
	2		ständig nass constantly wet	0,50		320		C35/45	
	3	Chlorid chloride	nass / trocken wet / dry	0,45		320		C35/45	
XF	1	Frost /+ Salz freeze-thaw	mäßige Wassers. o. T. moderate water saturation (o.T.)	0,60)	280		C25/30	
	2		mäßige Wassers. m. T. moderate water saturation (m.T.)	0,55	+ LP	300		C25/30	
	3			0,50		320		C35/45	
			hohe Wassers. o. T. high water saturation	0,55	+ LP	300		C25/30	
			(o.T.) hohe Wassers. m. T.	0,50		320		C35/45	
	4	/+ salt	high water saturation (m.T.)	0,50	+ LP	320		C30/37	
ХА	1	Saure	schwach angreifend weakly corrosive	0,60)	280		C25/30	
	2		mäßig angreifend moderately corrosive	0,50		320		C35/45	
	3	Chem. Angriff chemical attack	stark angreifend strongly corrosive	0,45		320		C35/45	
ХМ	1	\bigcirc	mäßiger Verschleiß moderate wear	0,55		300		C30/37	
	2		starker Verschleiß severe wear	0,45		320		C35/45	
	3	Verschleiß wear	sehr starker Verschleiß very severe wear	0,45		320		C35/45	



Which applications are suitable for AAMs?

- Exposure classes define a minimum characteristic compressive strength requirements to be satisfied by the material used (AAMs should satisfy these requirements)
- Specific applications require additional properties, but not necessarily a minimum compressive strength value:
 - High-rise building: **early strength** development (time saving) and high compressive strength (material and cost saving)
 - Shotcrete: high early strength and fast setting
 - Repair and retrofitting: high durability

ALKALI-ACTIVATED CONCRETE - APPLICATIONS



Images: 1 - Global Change Institute (GCI) – Queensland, Australia, 2013, EFC (Earth Friendly Concrete) – Wagners; 2 - UrbanEden solar decathlon house – University of Charlotte, USA, 2013, Pre-cast fly ash-based Geopolymer concrete walls; 3 -Thomastown Recreation and Aquatic Centre (TRAC) – Victoria, Australia, 2013, EFC (Earth Friendly Concrete) – Wagners; 2 - UrbanEden solar decathlon house – University of Charlotte, USA, 2013, Pre-cast fly ash-based Geopolymer concrete walls; 3 -Thomastown Recreation and Aquatic Centre (TRAC) – Victoria, Australia, 2013, Ecrete pre-mixed concrete pavement – Zeobond; 4 - Railways sleepers, NSW, Australia, Prestressed Geopolymer concrete walls; 3 -Thomastown Recreation and Aquatic Centre (TRAC) – Victoria, Australia, 2013, Ecrete pre-mixed concrete pavement – Zeobond; 4 - Railways sleepers, NSW, Australia, Prestressed Geopolymer concrete walls; 3 -Thomastown Recreation and Aquatic Centre (TRAC) – Victoria, Australia, 2013, Ecrete pre-mixed concrete for a geopolymer, and tentral section of geopolymer concrete, International Diracid Ecopolymer, MATEC Web of Conferences 97, 01026, Antoni, Satria, Hardjito, Effect of variability of fly ash obtained from the same source on the characteristics of Geopolymer, MATEC Web of Conferences 97, 01026, Antoni, Satria, Hardjito, Effect of variability of fly ash obtained from the same source on the characteristics of Geopolymer, MATEC Web of Conferences 97, 01026, 2017; Muhammad et al., Effect of Prest Centre (TRAC) – EV 206 - Concrete – Specification, performation, performatio

FIBRE-REINFORCED AAMs – FUTURE APPLICATIONS



Agricultural Farm and animal storage structures, walls, silos, paving, etc.



Airports & Ports Runways, taxiways, aprons, seawalls, dock areas, packing and loading ramps



Highways, Roadways & Bridges Conventional concrete paving, SCC, barrier rails, curb and gutter work, etc.



Mining & tunnelling Precast segments and shotcrete, which may include tunnel lining, shafts, slope stabilization, sewer work, etc.



Precast elements Precast pre-stressed roof elements & beams, façade panels, tanks, containers, pipes, piles, etc.



Residential Driveways, sidewalks, basements, colored concrete, foundations, drainage, etc.



Shell structures FRC is well suited for complex shapes, where fibres combine with traditional reinforcement to obtain thicker sections



UHPFRC Civil structures and bridges, building components, etc.



Warehouse & industrial Light- to heavy-duty loaded floors and roadways



Waterways Dams, lock structures, channel linings, ditches, storm-water structures, etc.







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DuRSAAM

Laura Rossi PhD Candidate (ESR4) – Institute of Concrete Structures and Building Materials, Karlsruhe Institute of Technology (KIT) E: <u>laura.rossi@kit.edu</u> <u>www.kit.edu</u> – <u>www.dursaam.eu</u>

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