Screed Additives – Mode of action and application

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Introduction – Who we are?

Competence Center for Flooring construction for more than 30 years:

- IBF = Institut für Baustoffprüfung und Fußbodenforschung
- Material testing (raw materials, binder);
- Performance testing;
- Trouble shooting
- Support of organizations with respect to technical questions;
- External inspection service according to RAL GZ 818;
- Large scale flooring projects for special purpose.

External Inspection service RAL-GZ 818

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VMPA Schallschutzprüfstelle nach DIN 4109 · VMPA Betonprüfstelle W nach DIN 1045

GÜTESCHUTZ ESTRICHE
RAL-GZ 818
PRÜFZEUGNIS Nr. B 13/14
BAUSTELLENÜBERPRÜFUNG

Antragsteller: Mustermann

Baustelle: 45739 Oer-Erkenschwick, Ewaldstraße, BV Reimann, Caluna Park
Fremdüberwachung vom: 13.03.2014
Prüfungsdurchführung: Die Prüfungen erfolgten nach den „Güte- und Prüfbestimmungen für Estriche" RAL-GZ 818 unter Zugrundelegung der einschlägigen DIN EN-Normen und Richtlinien. Überprüft wurde die handwerkliche Ausführung der Arbeiten unter Zugrundelegung der genannten Vorschriften. Die Untersuchungen beinhalten nicht die Überprüfung der erforderlichen planerischen Vorgaben der Bauwerksplanung.

1. Zuschlag		**7. Abdeckung**	
Zusammensetzung:	0/8 mm	Art:	} PE-Folie
Art:	Kiessand	Verlegung:	
Lagerung:	1	**8. Randfugen:**	1
2. Bindemittel		**9. Anschlüsse:**	1
Art:	CEM I 32,5 R	**10. Fugen:**	1
Lagerung:	1	**11. Festigkeit de Estrichoberfläche:**	1
3. Mörtel		**12. Ebenheit:**	1
Art:	Zementestrich	**13. Baustellenorganisation:**	/
Beschaffenheit:	1	**14. Estrichverlegung:**	/
Förderung:	Pumpe	**15. Laborwerte des Zuschlags**	
4. Baustellenbedingungen:	1	Körnungsziffer k =	2,71[1)]
5. Untergrundbeschaffenheit:	2	Humine Bestandteile:	kein erhöhter Anteil
6. Dämmschicht		**16. Trittschalldämmung**	
Art:	EPS + EPS T	Prüfzeugnis Nr. T	14/14
Lagerung:	1	**17. Gesamtbewertung:**	**1**
Verlegung:	1		

Bewertung: 1 = keine Beanstandungen, 2 = Beanstandungen, 3 = Mängel, 4 = schwerwiegendere Mängel

Bemerkungen: Prüfung am verlegten Estrich
[1)] entspricht etwa Sieblinie B_8/C_8 nach DIN 1045-2

53842 Troisdorf, 26.03.2014

Institutsleitung
Dipl.-Ing. Müller

Institut für Baustoffprüfung und Fußbodenforschung — Estriche Beläge Beton
(Siegel)

Sachbearbeiter
Malura

Large scale flooring projects

Seminars und Trainings

DIN EN 13813: Screed material and floor screeds - Screed materials - Properties and requirements;

According to EN 13318 a screed is one or more layers of screed mortar placed at the construction site on a base. It can either be bonded to the base or not or laid on a separating layer or on an insulating layer. Its purpose is to fulfill one or more of the following functions
- achieve a certain required height;
- used as a base for flooring material;
- used directly as a wearing surface.

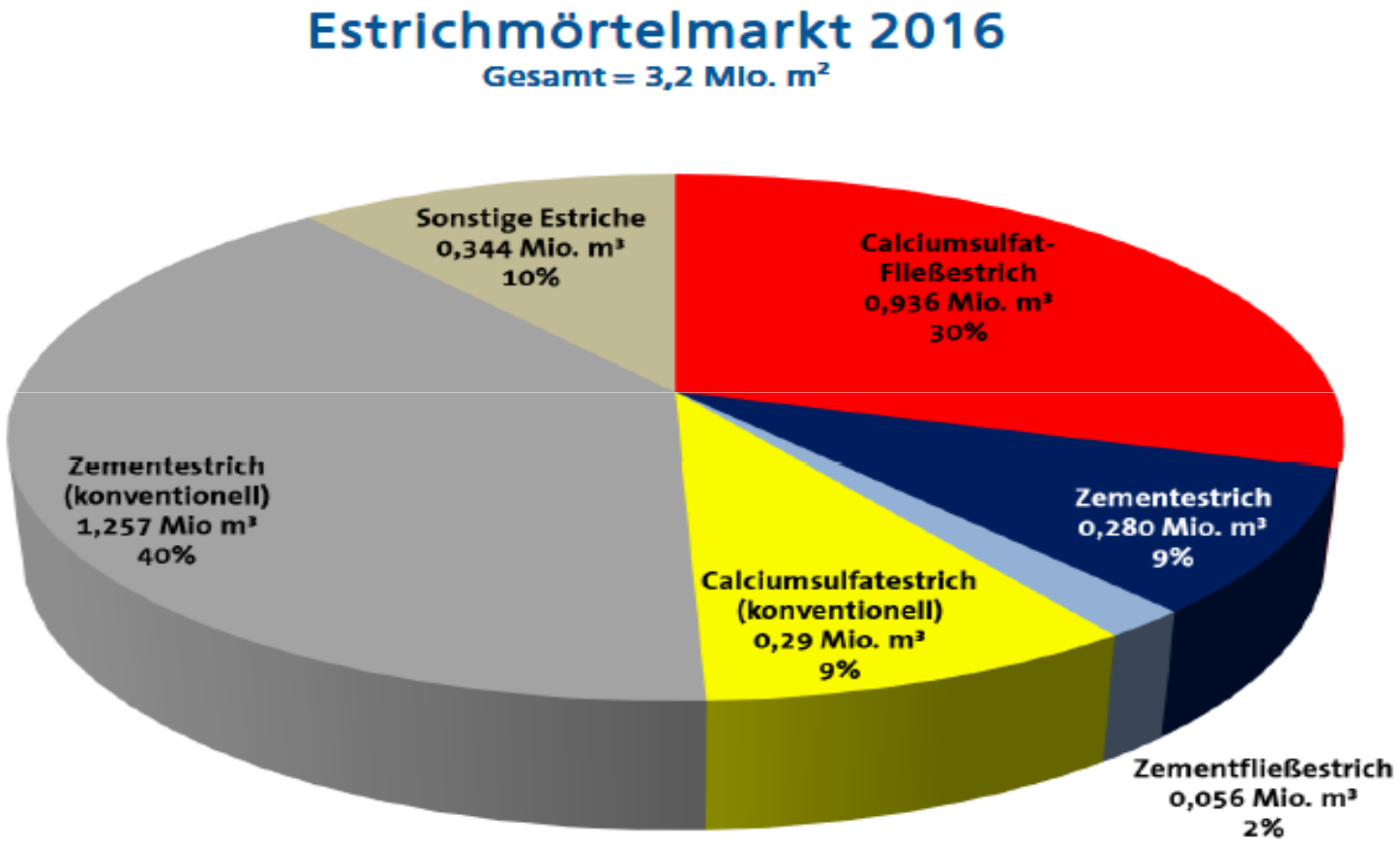
In Germany the term screed includes screed mortar, screed materials and the finished product.

Only such binders, aggregates, **admixtures**, **additives** and water may be used in the production of screed mortars that guarantee the properties that the manufacturer has named.

CT cementitious screeds **CA** calcium sulfate screeds

German Purity Law on Screed?

Anteil der Estrichmaterialien



Usual properties of screed mortars

Table 1. Screed materials and tests which apply to each type

Screed materials based on:	compressive strength	flexural strength	wear resistance "Böhme"	wear resistance "BCA"	wear resistance to rolling wheel	surface hardness	resistance to indentation	resistance to rolling wheel with floor covering	setting time	shrinkage and swelling	consistency	pH value	modulus of elasticity	Impact resistance	bond strength
Cement	N	N	N* (one of three)			O	-	O	-	O	O	O	O	O*	O
Calcium sulfate	N	N	O	O	O	O	-	O	O	O	O	N	O	-	O
Magnesite	N	N	O	O	O	N*	-	O	-	O	O	O	O	-	O
Mastic asphalt	-	-	O	O	O	-	N	O	-	-	-	-	-	-	-
Synthetic resin	O	O	-	N* (one of two)		O	-	O	-	O	O	-	O	N*	N

N = Normative O = Optional, where relevant - = not relevant

* only for screed material intended for wearing surfaces

DIN EN 13318
Chapter 3.4-3.8 Definitions

- **Admixture:** Material added in small quantity during the mixing process to modify the properties of the screed material in the fresh and/or hardened state

- **Air entraining admixture:** Admixture that allows a controlled quantity of small, uniformly distributed air bubbles to be incorporated during mixing of screed material and which remain after hardening

- **Set retarding admixture:**

  Admixture which delays the beginning of setting of screed material

- **Plasticizing admixture:** Admixture which, without affecting the consistence, permits a reduction in water content of a screed material, or without affecting the water content increases the flow or which produces both effects simultaneously.

- **Super plasticizing admixture:**

  Admixture which, without affecting the consistence, permits a high reduction in the water content of a cementitious screed material, or which, without affecting the water content increases the flow considerably, or which produces both effects simultaneously.

- **Additives:** Material added to a screed material to modify the chemical and/or the physical property

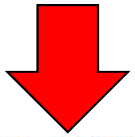
Standardization German DIN 18560-Estriche

- DIN EN 18560-2: Estriche im Bauwesen Teil 2:
  Estriche und Heizestriche auf Dämmschichten (schwimmende Estriche)

5.3 Estrich

5.3.1 Allgemeines

Der Estrich ist nach DIN 18560-1 herzustellen.



Bei Heizestrichen auf Basis von Calciumsulfat oder Zement dürfen nur solche Zusatzmittel verwendet werden, die den Volumenanteil der Luftporen des Mörtels um nicht mehr als 5 % erhöhen.

Mode of Action

Materials	Abbreviation-German	Mode of action
Super plasticizing admixture	**FM**	physical
Air entraining admixture	**LP**	physical
Stabilizing admixture	**ST**	physical
Set retarding admixture	**VZ**	chemical
Set accelerating admixture	**BE**	chemical

Superplasticizing Admixtures

Mode of action

- Reduction of surface tension of water
- Lubricant
- Reverse electrical charge

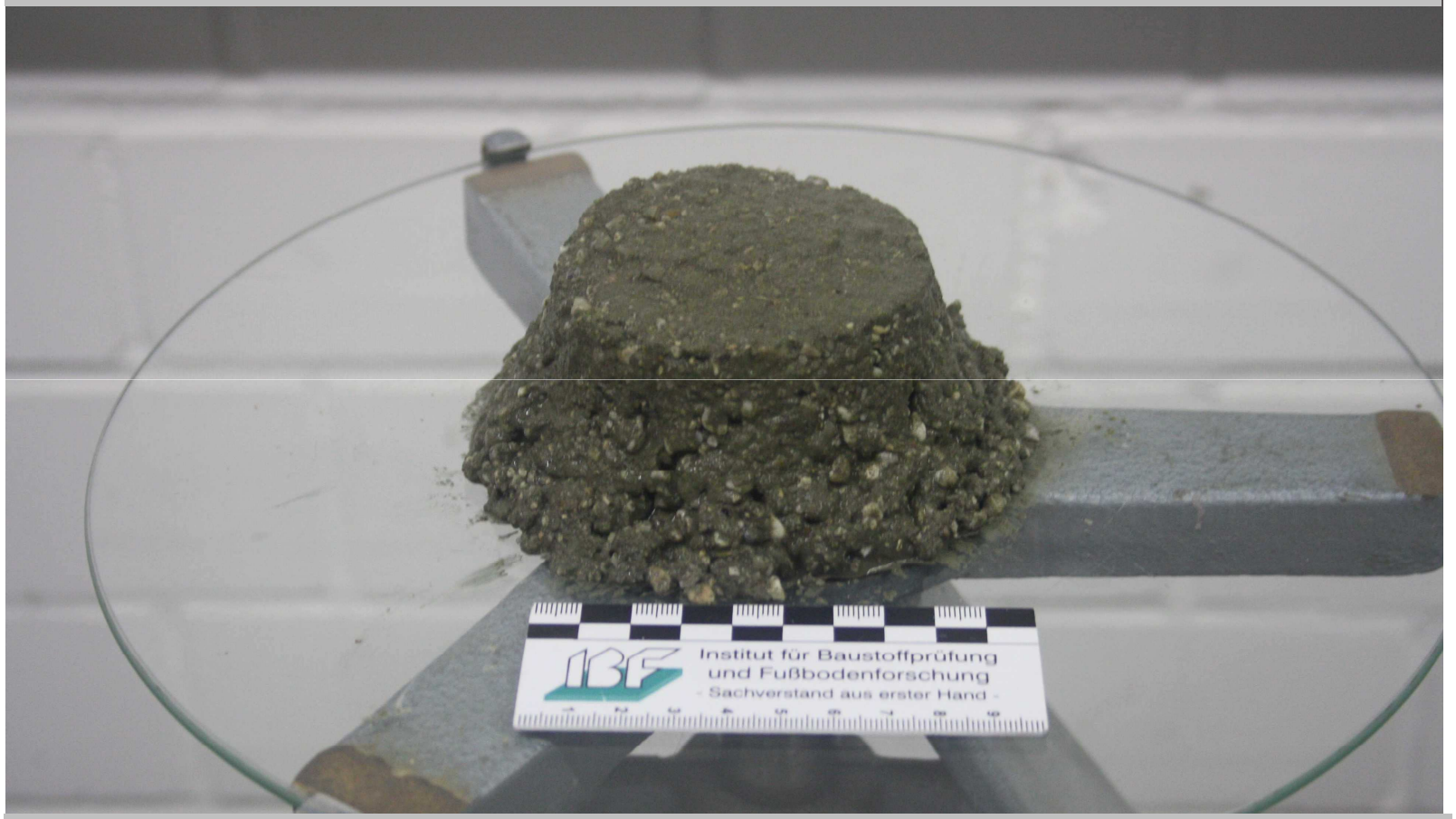
Mode of action

Improved performance by using less water

Sand A/B_8; MV 1:6; w/c ≈ 0,70; without admixture
Before flow

Mode of action

Improved performance by using less water



Sand A/B_8; MV 1:6; w/c ≈ 0,7; without admixture
flow ≈ 12 cm

Mode of action

Improved performance by using less water
(identical recipe using ≈ 1% admixture)

Sand A/B_8; MV 1:6; w/c ≈ 0,7; with admixture
flow ≈ 20 cm

Mode of action

Sand A/B_8; MV 1:6; w/c ≈ 0,7;
without admixture
Flow ≈ 12 cm

at 50 kg cement/pump:

w/c 0,7 = 35 l water

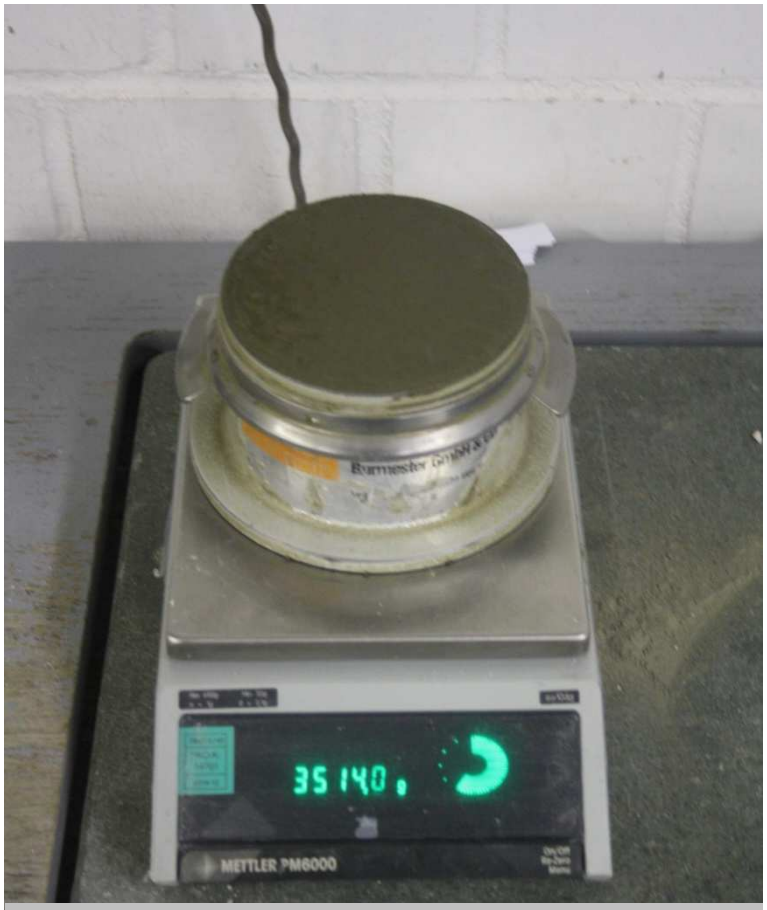
w/c 0,5 = 25 l water

Sand A/B_8; MV 1:6; w/c ≈ 0,5;
with admixture
flow ≈ 12 cm

Air entraining admixture

- Improvement of performance
- Improvement of density
- Better enclosure of heating tubes

Sand A/B_8; MV 1:6; w/c ≈ 0,5;
with admixture
flow ≈ 12 cm
density ≈ 2,16 kg/dm³



Sand A/B_8; MV 1:6; w/c ≈ 0,7;
without admixture
flow ≈ 12 cm
density ≈ 2,26 kg/dm³

Air entraining admixture

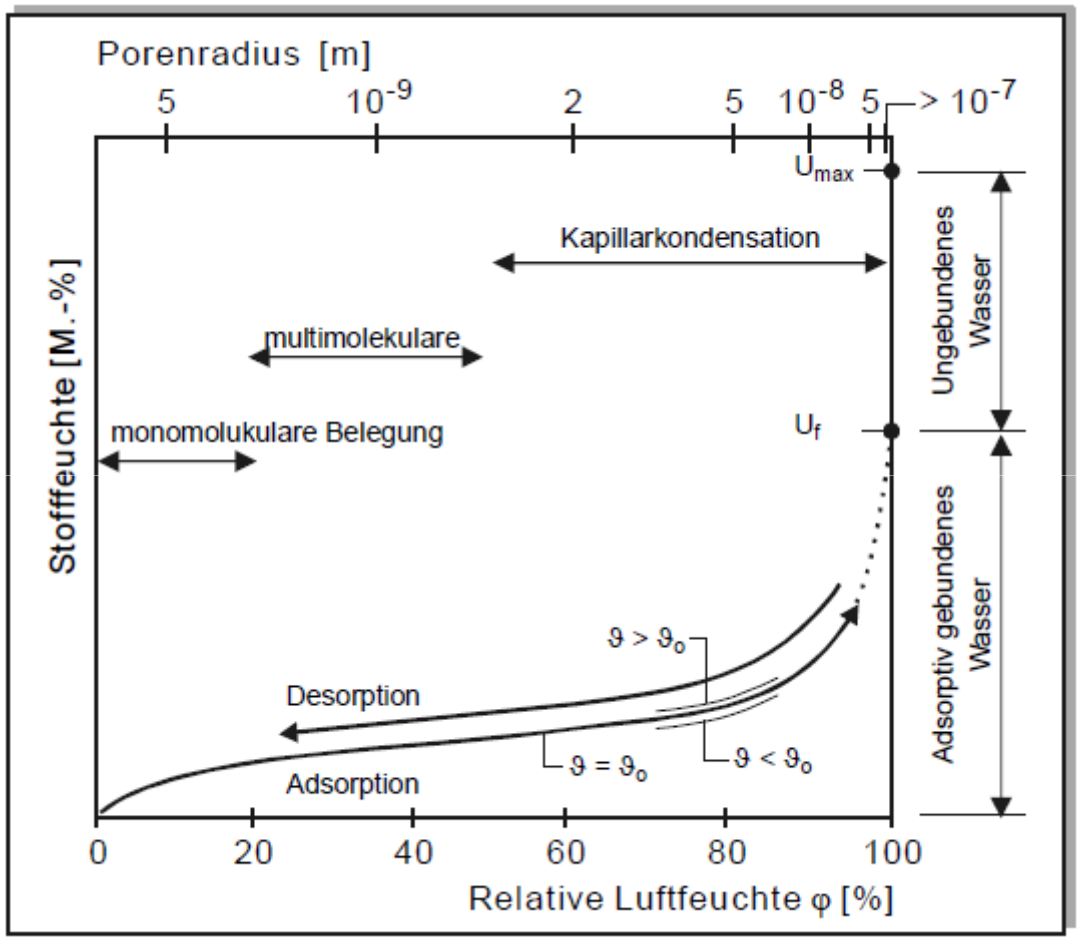
Sand A/B_8; MV 1:6; w/c ≈ 0,7;
without admixture
flow ≈ 12 cm
Air entraining content ≈ 3 %

Sand A/B_8; MV 1:6; w/c ≈ 0,5;
with admixture
flow ≈ 12 cm
Air entraining content ≈ 10 %

Air entraining admixture - Strength

Screed	fresh	hardened		confirmation
	Air entrainer	Flexural strength	Compressive strength	Flexural strength
	Vol-%	N/mm²	N/mm²	N/mm²
Screed without Admixture	2,8	6,0	40	3,8 (CT-F5)
Admixture A	9,7	5,1	33	3,1 (CT-F4)
Admixture B	12,7	4,1	21	2,4 (≈CT-F4)

Drying behaviour-sorption isotherme



Reference: PhD Thesis Dr. Wiegrink TU-München 2002

Drying Behaviour

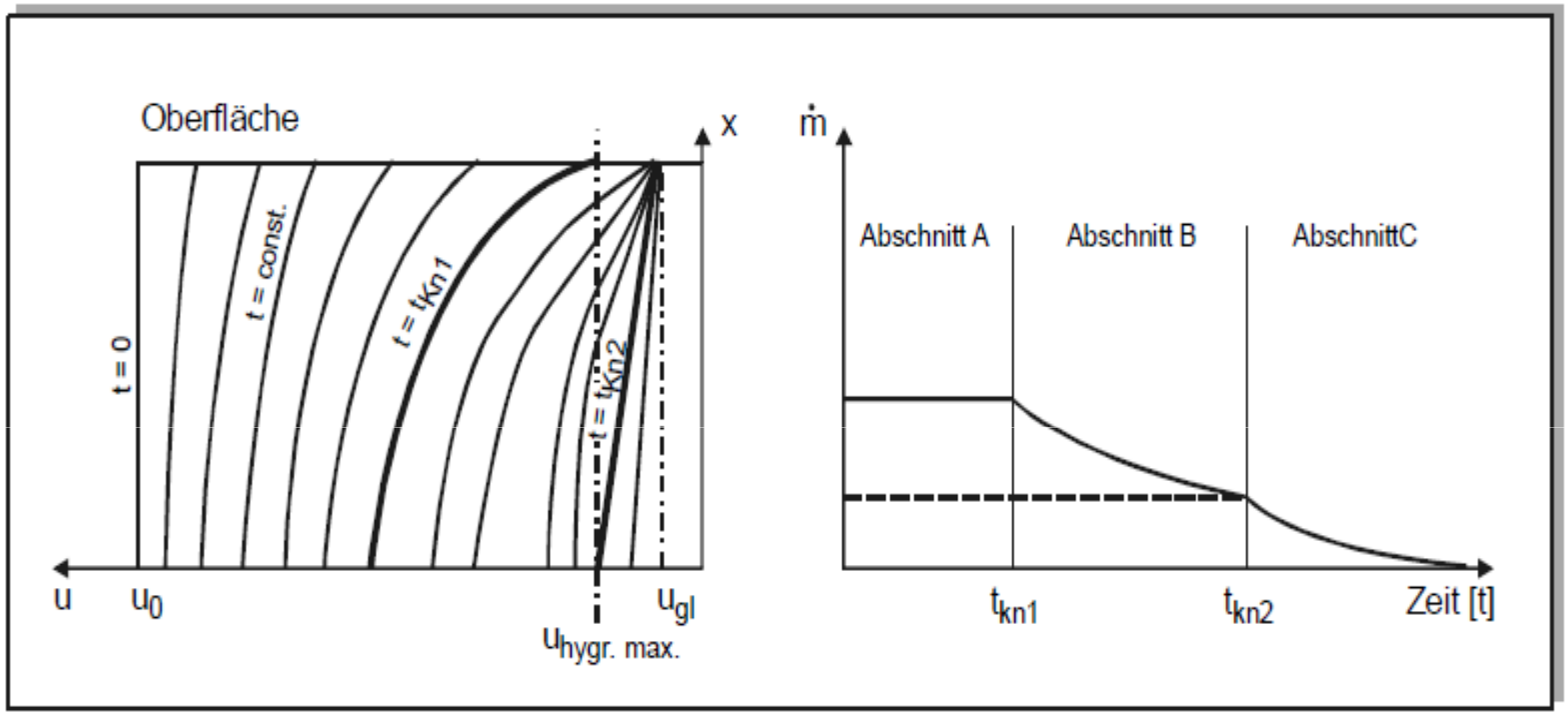


Bild 24: Charakteristischer zeitlicher Verlauf der Trocknungsgeschwindigkeit und der Feuchteverteilung bei einseitiger Austrocknung eines hygroskopischen, kapillaraktiven Baustoffs

Reference: PhD-Thesis Dr. Wiegrink TU-München 2002

Additives-products to enhance the drying process

- Additives for enhancing of the drying process **without** deviations in the relevant moisture content of screed according to DIN 18560-1

These additives reduce the water need of screed, no chemical binding of water

- Additives for enhancing of the drying process **with** deviations in the relevant moisture content of screed according to DIN 18560-1

Special products according to DIN 18560-1

Special definitions of limit values for CM measurement.

Factors influencing the drying process

- **Screed:**
  - Water/cement ratio during production
  - Type and amount of cement
  - Type of aggregate (sand)
  - Thickness of screed

- **Climatic conditions:**
  - Air temperature
  - Relative humidity
  - Air exchange after installation of screed

Chemical composition of admixtures

- Products similar to additives used in concrete industry:

- Naphthalinsulfonates
- Lignosulfonates
- Melaminesulfonates

- Polycarboxylates (PCE)

- Additives for concrete are specified according to EN 934-2
- Performance tested according to annex ZA;
- CE labeled
- Products not specified are regulated on a national basis (Germany: Allgemeine bauaufsichtliche Zulassung-abZ)
- Admixtures and additives for screed are not covered by EN 934 or national regulations
- Certification system Switzerland (FSHBZ-Gütesiegel)

Performance Testing

- Technical information from the BEB (11/2016)
- Description of a possible procedure for performance testing
- Development of a certification program by IBF in early 2017
- Principle: Testing of a admixture or additive based on a comparison of

  - Screed **without** admixture/additive
  - Screed **with** admixture/additive

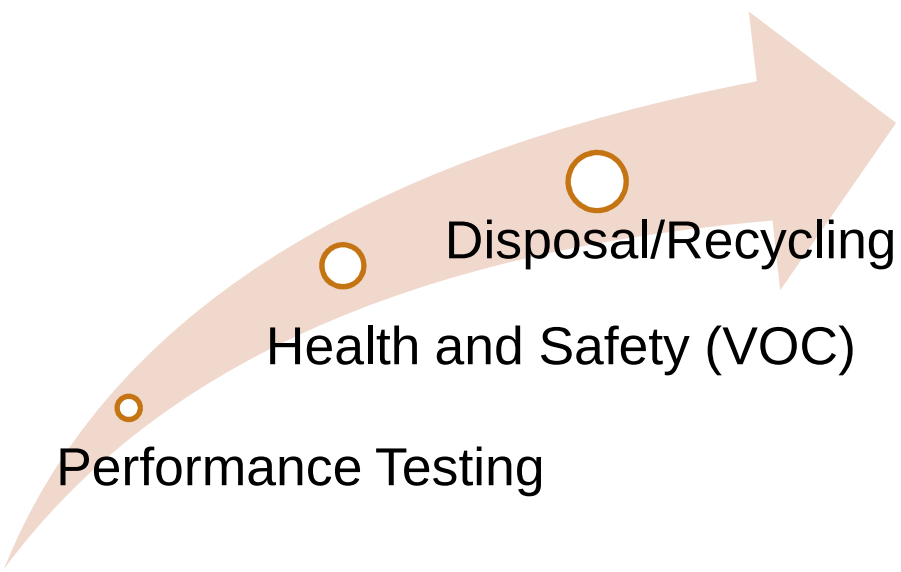
Result show the absolute performance of the admixture/additive!!!

IBF-Certification program

- **Initial Type Testing**
  - Testing of properties of fresh screed material (like air entrainers, flow and others)
  - Testing of properties of hardened material
    - Especially compressive and flexural strength after 7 and 28 days
    - Conformation test of flexural strength after 28 days
    - Bond strength
    - Drying performance and others
  - Compatibility testing
  - Identification by IR-Spectroscopy
  - Control of safety data sheet (GHS-Conformity)

- **Annual re-test** (short term)

Future Developments



Improvement by life cycle approach:

- Performance
- Usage stage
- Disposal/Recycling

- Testing of real conditions of additives for enhancing of drying conditions

Summary

- German Purity Law for Screed (?)
- New building technologies require faster and reliable screed
- Admixtures for different process types are available
- Water input by screed into new buildings needs to be reduced
- IBF Testing and certification program can be a first step to improve security of admixtures and additives for screed
- Lice Cycle certification will be a next step