



Dyckerhoff NANODUR® Compound 5941
... for simple production of UHPC

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Dyckerhoff NANODUR® Compound 5941 is a binder mix based on Dyckerhoff UHPC Cement NANODUR® with quartz powder in the ratio of 59:41. This enables the manufacture of ultra high performance concrete UHPC in conventional concrete mixing plants with air-dry aggregates pit sand 0/2 mm and chippings resp. gravel 2/5 mm for coarse-grained mixes and sand 0/2 mm only for fine-grained mixes.

Conventional UHPC consists of a great number of ultrafine components – for example, silica fume – that are normally not available in a concrete plant. Storage and handling are difficult. The use of high-performance mixers is indispensable for a UHPC of good homogeneity.

With NANODUR®, Dyckerhoff has developed a premium cement that, apart from the ultrafine cement components from Mikrodur Technology, already contains pozzolans based on synthetic silicas to control hydration. Combined with quartz powder, the result is the binder NANODUR® Compound 5941, which enables the simple production of UHPC with conventional aggregates in normal concrete mixing plants. All ultrafine particles < 0.25 mm are in advance intensively mixed as powder in a high-performance mixer with cutter heads in the cement plant, i.e., independent of the wet mixing process of the UHPC. In this way, the dense packing desired in the dry mix is reliably achieved.



The binder is delivered in silo trucks and processed in the concrete plant in the same manner as cement. The filling level of the mixer ranges at around max. 50%, and the mixing times must be adjusted to local conditions.



Fig. above:
Raw materials for UHPC
PCE superplasticizer, water,
chippings, Nanodur Compound 5941, sand

High-performance powder mixer
with cutter head

Application examples UHPC with Nanodur Compound 5941



Stairway BAU 2011, Munic



Coat rack Biblehouse, Frankfurt



Parabolic reflector, TU Kaiserslautern



Bridge strengthening, TU Graz

Preparation

When using naturally moist aggregate, protection from the influence of weather is important. Prior to the production of UHPC, the actual water content must be determined and the intrinsic dampness of the aggregate deducted from the overall water content.

Mixing

Aggregate and Nanodur Compound 5941 must be premixed in a dry state and afterwards water and PCE superplasticizer are added. Fibers must be separated and can be added either to the dry mix or after the desired consistency has been reached. Important: The mixing times (> 5 minutes) depend on the dissolution and the effectiveness of the PCE superplasticizer.



UHPC from a ready-mixed concrete plant with pan mixer



Fig. above:
Slender UHPC columns
d = 7 cm

Fish breeding basins
35 m x 5 m



Binder data with sand with a w/c ratio of 0.5 in accordance with DIN EN 196

Nanodur Compound 5941		grey	white
Water demand	[%]	26	26
Initial setting time	[min]	> 150	> 150
Compressive strength 2 d	[MPa]	15	10
Compressive strength 28 d	[MPa]	40	30

Examples of mix design		Coarse mix E80	Coarse mix E45	Fine mix
Nanodur Compound 5941 grey	[kg/m ³]	1.050	1.050	1.050
Pit sand 0/2 mm (air-dry)	[kg/m ³]	-	430	1.150
Chippings 2/5 mm (air-dry)	[kg/m ³]	-	880	-
Durigid 1/3 mm	[kg/m ³]	1.193	-	-
Durigid 3/6 mm	[kg/m ³]	430	-	-
Micro steelfibres 020/10	[kg/m ³]	-	60	-
PCE-superplasticizer	[kg/m ³]	17	15	18
Water	[kg/m ³]	149	158	168
Mechanical values after 28 days specimen storage under water at 20 °C				
3-point flexural bending strength*	[MPa]	23	20	18
Prism compressive strength*	[MPa]	180	150	130
Cylinder compressive strength**	[MPa]	150	130	120
Static Young's modulus**	[MPa]	80.000	50.000	45.000

* Prism 4 cm x 4 cm x 16 cm

** Cylinder d = 15 cm, h = 30 cm

Dyckerhoff Nanodur Compound 5941 grey and white are high-performance binders based on cement main constituents in accordance with DIN EN 197-1 and quartz powders in accordance with DIN ISO 3262-13. Conformity of the technical specifications of the product supplied with the values given in this data sheet is ensured by factory production control carried out at the Neuwied plant (Germany) in compliance with DIN EN 197 Part 2 and on the basis of DIN EN ISO 9001.

Based on the operating and process instructions specified by the quality management system of this plant, continuous production monitoring is performed on the raw materials as well as the intermediate and final products. This facilitates ongoing verification of the conformity of the product properties with the corresponding requirements.

Important notice:

- Prolonged exposure of the concrete surface to moisture combined with deficient ventilation may lead to a permanent blue discoloration caused by the blast furnace slag present in Nanodur Compound 5941. To counteract this tendency, for these conditions a suitable air permeable hydrophobization of optically sophisticated elements should be applied as early as possible. Afterwards, the elements have to be stored for at least 1 week under dry conditions.
- Approx. 10 % reduced strength in case of Nanodur Compound 5941 white.



Machine bed of Nanodur® concrete – HOMAG Sorb Tech®

This bulletin contains general information only. It cannot consider chemical and/or physical influences of substances unknown to us having any contact with our products at mixing or in any other way at work on the construction site. Hence the information is perhaps not suitable for the actual application. In this case individual tests considering the actual on-site conditions are necessary. The information in this bulletin cannot be seen as a quality guarantee.