

Fact Sheet

Recycling carbon reinforced concrete

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Publisher: C³-Verband (C³-Association)

Dresden, september 2022



Recycling reinforced concrete

In reinforced concrete construction, any foreign matter (floor coverings, insulation panels etc.) is largely removed from the structures – for recycling to be carried out. Subsequently, demolition equipment and tools are used to pre-crush the material into pieces with a maximum size of 50 cm. Then the demolished material is crushed by crushers to the final size of up to 10 cm and the steel reinforcement is detached from the concrete. Finally, the reinforcement is sorted out of the concrete-steel mixture by means of magnets. The steel fraction has a material purity of almost 100 %.

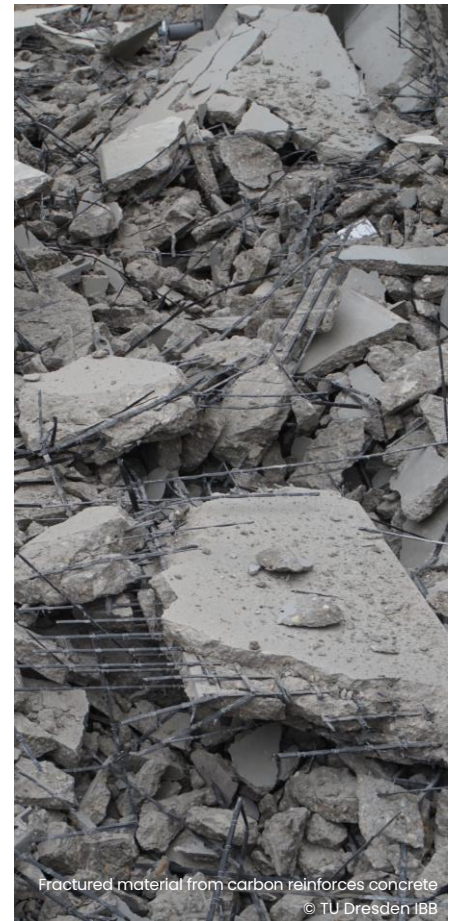
However, it is not possible to produce 100 % pure material from recycled concrete, since adhesions or foreign matter (plastic spacers etc.) cannot always be completely removed. For high-quality reuse as aggregate in the production of fresh concrete, up to 2 % foreign matter by mass is therefore permitted. Otherwise, the material is used as a base course in road and pavement construction or for backfilling. The steel is melted as scrap in steelworks and processed into new steel with the addition of further substances.

Recycling carbon reinforced concrete

In carbon reinforced concrete construction, the coarse foreign matter is also removed first, the structures are crushed into pieces, the concrete is separated from the carbon fibre reinforcement in crushers, and the concrete fraction is further crushed. Unlike steel, carbon is not magnetic, so that the two fractions cannot be separated using magnetic separators. Instead, alternative sorting processes (camera-based processes etc.) are used, similar to those used for sorting plastics or glass. The broken material is conveyed on a belt in the sorting plant, the reinforcement elements are detected on the basis of different colour and geometry and blown out by targeted air blasts. With the plants commonly in use today, up to 98 % of the reinforcement can already be removed from the demolition material.

The C³-Association was able to prove this in 2019 within the context of its “C³ – Carbon Concrete Composite” project (refer also to further literature).

As with reinforced concrete, the concrete is recycled. The valuable carbon fibres are already being extracted from the recovered carbon fibre reinforcements and reused for new products. Alternatively, the small quantities of reinforcements containing carbon fibres that have accumulated in the construction industry up to now can be thermally recycled.



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Camera-based sorting of fractured material from carbon reinforced concrete | © TU Dresden IBB

Current quantities of recycling material containing carbon reinforced concrete

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A service life of between 100 and 200 years is estimated for components made of carbon reinforced concrete. If parts of a structure are dismantled beforehand, the service life is usually over 50 years. As a result, there is currently hardly any waste containing carbon reinforced concrete. At the moment, waste results from research and development work that requires test specimens, as well as from faulty production end production waste.

Future quantities of recycling material containing carbon reinforced concrete

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Regardless of the long service life of a structure or component made of carbon reinforced concrete, the quantities of recycled material containing carbon reinforced concrete will increase in line with demand.

Compared to other sectors (automotive, aerospace, wind power etc.), the relative share in the material cycle is expected to remain low in the coming decades.

Handling critical concentrations of non-biodegradable, respirable fibres

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In order to prevent the release of non-biodegradable, respirable fibres during production, processing, use and recycling, the institutions that are members of the C³-Association have agreed not to use carbon fibres that are prone to the relevant release of critical fibre dusts.

This agreement is set out in the RAL registration RAL-RG 351, which was developed together with the Federal Institute for Occupational Safety and Health (BAuA) and the Employer's Liability Insurance Association for the Construction Industry (BG Bau) and reviewed by other experts from the professional world.

Further development

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Although the processing of carbon reinforced concrete and the use of recycled concrete and fibres is possible in principle, recycled material containing carbon reinforced concrete is not yet an established part of a closed material cycle. Within the framework of the current

project "WIR! recyceln Fasern" (We! recycle fibres), the C³-Association is committed to completing the circular value creation chain and closing it in the near future. In addition, it aims to offer mesh end bar-shaped reinforcements made of recycled carbon fibres too in the future.

Further literature

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Kortmann J.: Verfahrenstechnische Untersuchungen zur Recyclingfähigkeit von Carbonbeton. In: Otto J., Jehle P. (Hrsg.): Schriftenreihe „Baubetriebswesen und Bauverfahrenstechnik. 2020. S.94 ff, S. 103 ff, S. 160 ff.

RAL-RG 351: Verhinderung von Gefährdungen durch biobeständige, lungengängige Faserstäube bei der Carbonbetonbauweise. 2021. 5 S.

Further links including explanatory films

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<https://carbon-concrete.org/carbonbeton/recycling>

<https://www.wir-recyceln-fasern.de>

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