Description

Anchor sleeve

The invention relates to an anchor sleeve for fixing an anchor rod with a curable composition in a hole in an anchoring substrate, in accordance with a first aspect of the present inventionhaving the features of the preamble of claim 1. In addition, the invention relates to a fixing arrangement having the anchor sleeve, in accordance with a second aspect of the present invention,having the features of the preamble of claim 13 and to a method of fixing an anchor rod with the anchor sleeve, in accordance with a third aspect of the present inventionhaving the features of the preamble of claim 15. The anchoring substrate is, for example, a brick or concrete wall, ceiling, beam, joist or the like of a building. The hole can, for example, have been drilled, that is to say can be a drilled hole, or it can have been made by a suitable core or the like during the casting of concrete. The curable composition can be an adhesive, a resin or a mortar; in the case of mortar, in addition to cement mortar, synthetic resin mortars especially come into consideration. The curable composition can have one or more components. The list is not exhaustive. After curing, the curable composition is also referred to as the cured composition. The anchor rod can be, for example, a threaded rod or a DYWIDAG bar. This list is likewise not exhaustive. A special anchor rod having, as expansion body, a number of cones which are integral with one another and are arranged one after the other axially is not provided *per se*, but is also not excluded. Strictly speaking, the cones are truncated cones. The fixing of an anchor rod with a curable composition in a hole in an anchoring substrate is also referred to as chemical anchoring.

German Offenlegungsschrift DE 38 31 683 A1 discloses an anchor rod having, as expansion body, a number of cones arranged one after the other axially, the last of which cones is adjoined by a smooth-walled shank and then by a threaded portion. On the anchor rod there is arranged an expansion sleeve from which the threaded portion projects. In the region of the cones, the expansion sleeve has complementary hollow cones, so that, in the event of axial displacement of the anchor rod in the expansion sleeve, the anchor rod expands the expansion sleeve. The expansibility of the expansion sleeve is provided by longitudinal slots. If the hole in which the expansion sleeve is anchored becomes wider, for example as a result of cracks being formed in the anchoring substrate, the anchor rod, when subjected to tensile stress, is displaced

in the anchor sleeve and expands the sleeve further. The further expansion of an anchor sleeve in the event of a hole's becoming wider is also referred to as "follow-up expansion". In the case of a friable anchoring substrate, the Offenlegungsschrift suggests a hole of relatively large diameter in which the expansion sleeve is fixed using a composite composition or an adhesive mortar.

International patent application WO 2005/124163 A1 discloses, as anchor rod, a threaded rod which is arranged in an anchor sleeve. The anchor sleeve is perforated, the holes forming openings allowing passage of a mortar. The anchor sleeve has the purpose of holding the mortar in cavities in the anchoring substrate in the region of the anchor rod and of counteracting loss of mortar into the cavities, so that sufficient mortar remains for fixing the anchor rod in the anchoring substrate outside the cavities. Anchoring substrates having cavities are, for example, perforated bricks and hollow blocks.

The problem of the invention is to propose an economical anchor sleeve for fixing an anchor rod with a curable composition in a hole in an anchoring substrate, which anchor sleeve exhibits follow-up expansion behaviour.

That problem is solved according to the ~~invention by the features of claims 1, 13 and 15~~first aspect, the second aspect, and the third aspect of the present invention.

In the first aspect of the present invention, an anchor sleeve for fixing an anchor rod is disclosed, with a curable composition in a hole in an anchoring substrate, wherein the anchor sleeve has on its outer side at least one expansion surface which comprises alternating rising and falling regions in a longitudinal direction of the anchor sleeve, wherein the anchor sleeve has at least one opening allowing passage of the curable composition, characterised in that the anchor sleeve has a longitudinal slot which forms one of the at least one opening.

In the second aspect of the present invention, a fixing arrangement is disclosed, comprising an anchor sleeve arranged on an anchor rod for arrangement in a hole in an anchoring substrate, the anchor rod being fixed in the anchor sleeve with a curable

composition and the anchor sleeve being fixed in the hole in the anchoring substrate with the curable composition, wherein the anchor sleeve has on its outer side at least one expansion surface which comprises alternating rising and falling regions in a longitudinal direction of the anchor sleeve, wherein the anchor sleeve has at least one opening allowing passage of the curable composition, characterised in that the anchor sleeve has a longitudinal slot which forms one of the at least one opening.

In the third aspect of the present invention, a method of fixing an anchor rod in a hole in an anchoring substrate with the aid of an anchor sleeve and with the aid of a curable composition is disclosed, wherein the anchor sleeve has on its outer side at least one expansion surface which comprises alternating rising and falling regions in a longitudinal direction of the anchor sleeve, wherein the anchor sleeve , the anchor rod and the curable composition are introduced into the hole, wherein when introducing the anchor rod into the hole, the curable composition is displaced towards the mouth of the hole, opposite to the direction through which the anchor sleeve and the anchor rod are introduced into the hole, wherein the anchor rod is pushed through the anchor sleeve so that it projects out of the anchor sleeve at the end that is at the front in the direction of introduction of the anchor sleeve into the hole, wherein the anchor sleeve has at least one opening allowing passage of the curable composition, characterised in that the anchor sleeve has a longitudinal slot which forms one of the at least one opening.

Also disclosed is an~~The~~ anchor sleeve that~~according to the invention~~ has on its outer side at least one expansion surface which – seen in a longitudinal direction of the anchor sleeve – runs from inside to outside. In other words, the spacing of the expansion surface from a longitudinal centre axis of the anchor sleeve increases in the longitudinal direction of the anchor sleeve. For fixing, the anchor rod is arranged in the anchor sleeve and the anchor sleeve is arranged in the hole in the anchoring substrate, it also being possible for the anchor sleeve to be arranged in the hole in the anchoring substrate first and for the anchor rod then to be arranged in the anchor sleeve. The anchor sleeve is fixed in the anchoring substrate with the curable composition and the anchor rod is fixed in the anchor sleeve, which can be carried out using the same curable composition or using a different curable composition or in some other way, for example by screwing the anchor rod into the anchor sleeve. The curable composition can be introduced into the anchor sleeve and/or into the hole in the anchoring substrate, the order in which the anchor rod is introduced into the anchor sleeve, the anchor sleeve introduced into the hole and the curable composition introduced into the anchor sleeve and/or into the

anchor sleeve is long, in order to clean the wall of the hole. It is unnecessary for the cleaning element to be held securely on the anchor rod.

One construction in accordance with the invention provides that the anchor sleeve has an inward indentation which is in engagement or enters into engagement with the anchor rod when the anchor rod is being inserted or has been inserted into the anchor sleeve. The indentation can be, for example, one or more beads projecting inwards from the anchor sleeve, which beads, similarly to teeth or the like, engage in, for example, a thread of the anchor rod in order to hold the anchor sleeve on the anchor rod in the longitudinal direction and, conversely, to hold the anchor rod in the anchor sleeve. It can be necessary or at least advantageous for the anchor sleeve to be held on the anchor rod in the longitudinal direction in order to be able to introduce the anchor sleeve into the hole with the anchor rod when the anchor sleeve has a larger external diameter than the diameter of the hole and the anchor sleeve is thus clamped in the hole. In the case of overhead mounting, the anchor sleeve holds the anchor rod in the hole when the anchor sleeve is held clamped in the hole and the anchor rod is held in the anchor sleeve. It is also possible for the anchor sleeve in the non-deformed state to taper towards one end, so that at the tapered end it has a smaller (smallest) internal diameter than the anchor rod and is held on the anchor rod in the longitudinal direction.

The fixing arrangement according to the ~~invention having the features of claim 13~~ second aspect of the present invention has an anchor rod which is arranged in an anchor sleeve of the kind described above. The anchor sleeve is arranged in a hole in the anchoring substrate. The anchor rod is fixed in the anchor sleeve with a cured composition and the anchor sleeve is fixed in the hole in the anchoring substrate preferably with the same cured composition or with some other cured composition, the cured composition being the curable composition after curing. The anchor sleeve has the at least one expansion surface described above which, in the event of the anchor rod's being subjected to axial stress which is transmitted to the anchor sleeve *via* the cured composition, exerts an expansion pressure on the cured composition surrounding the anchor sleeve and thus, if the hole becomes wider, for example as a result of cracks being formed in the anchoring substrate, effects follow-up expansion of the cured composition surrounding the anchor sleeve. As a result, the anchor rod remains fixed in the anchoring substrate

even if the hole becomes wider. The anchor sleeve is constructed in accordance with one or more of the embodiments of the invention described above.

The fixing arrangement according to the invention is provided especially also for a cracked anchoring substrate or for fixing the anchor rod in an anchoring substrate where crack formation is possible. In the event of tensile stress being exerted on the anchoring substrate transversely with respect to the hole and transversely with respect to the crack, such a crack, running into the hole, will result in opening of the crack and widening of the hole. By virtue of the follow-up expansion behaviour described, the fixing arrangement according to the invention also has good hold in a hole that is becoming wider. Not only is the fixing arrangement chemically anchored in the hole but also, in the event of the anchor rod's being subjected to axial stress, the cured composition is expanded by the expansion surfaces of the anchor sleeve and thereby pressed outwards against the wall of the hole. The crack running into the hole can pass through the drilled hole; it is also possible for a plurality of cracks to run into the drilled hole.

The method according to the third aspect of the present invention ~~invention having the features of claim 14~~ has been described above with reference to the anchor sleeve of the first aspect, and the fixing arrangement of the second aspect. The anchor rod is introduced into the anchor sleeve and the anchor sleeve is introduced into the hole in the anchoring substrate and the curable composition is introduced into the anchor sleeve and/or into the hole, the order not being specified and can be varied. One form of the method according to the invention provides that the hole is deeper than the anchor sleeve is long, for example the hole is approximately twice as deep as the anchor sleeve is long. The anchor rod is pushed through the anchor sleeve and projects out of the anchor sleeve at the end that is at the front in the direction of introduction of the anchor sleeve into the hole, the amount by which the anchor rod projects from the front end of the anchor sleeve not being greater than the amount by which the drilled hole is deeper than the anchor sleeve is long. On introduction of the anchor rod into the hole, the anchor rod displaces the curable composition previously introduced into the hole in a similar way to a piston so that, in a gap in the hole around the anchor rod, the curable composition flows back towards the mouth of the hole in a direction opposite to the direction of introduction of the anchor rod. If an intermediate space between the anchor sleeve and the anchor rod is not filled with the curable composition, the curable composition also enters the anchor