A method of coupling a first conduit to a device. The first conduit has a surface and is adapted for conducting a medium. A plastic material is brought at least partly on said surface and on said device. The plastic material has an electric conductor. An electric current flow through said electric conductor of the plastic material is initiated. Said plastic material is heated at least partly by said electric current flow for at least plastifying said plastic material.
COUPLING OF CONDUITS WITH LOCAL SEALING

BACKGROUND ART

1. Field of the Invention

The present invention relates to coupling of conduits.

2. Discussion of the Background Art

Couplings are used for allowing conduits adapted for conducting a medium to communicate. Known are, for example, light guides or fluid conduits for conducting light or a fluid, for example a liquid. A capillary, for example, can serve as a fluid conduit and as a light guide. Flow cells, for example, for analyzing a fluid can comprise a fluid conduit and a light guide. Flow cells can comprise different conduits communicating via one or more connections.

U.S. Pat. No. 6,526,188 B2 and the US 2001/001074 show a modular flow cell having a high optical throughput, a long optical path length and a small cross-section. The modular flow cell configuration includes remote ports or connections for liquid and light input and liquid and light output.

U.S. Pat. No. 5,444,807 shows a flow-through cell for use in the measurement of chemical properties of small volumes of fluid containing dissolved analytes.

U.S. Pat. No. 5,608,517 discloses a coated flow cell and a method for making the coated flow cell. The flow cell comprises a flow passage, wherein light directed into the flow cell is internally reflected down the flow passage.

U.S. Pat. No. 3,236,602 discloses flow cells and holders therefore, the calorimetric examination of a liquid to determine the quantity of a substance present in the liquid.

U.S. Pat. No. 4,477,186 discloses a photometric cuvette for optical analyses of through-flowing medium, made as a thin and narrow transparent tube requiring minimum sample amounts. Light, substantially parallel to the tube length, is led obliquely into the tube through its wall, is reflected and is led obliquely out through the tube wall to a detector.

EP 008915781 discloses an optical detector cell for determining the presence of a solute in a sample fluid. The optical detector cell includes a sample tube, inlet and outlet means for the sample fluid, and a first and second optical waveguide for passing a beam of light axially through the sample tube.

GB 2193313 A discloses an apparatus and method for measuring the spectral absorbance of fluid samples. The length of the light path through the sample is adjusted to optimize the amount of light absorbed by the sample.

U.S. Pat. No. 6,281,975 B1 shows a bent capillary flow cell with protruding end bulbs coaxial with centreline of an elongated centre cylindrical section of capillary tubing. The bulbs provide a high light throughput entrance window for the cell.

SUMMARY OF THE INVENTION

It is an object of the invention to provide an improved coupling of at least one conduit. The object is solved by the independent claims. Further embodiments are shown by the dependent claims.

According to embodiments of the present invention, a method of coupling a first conduit to a device is suggested. The first conduit comprises a surface and is adapted for conducting a medium. The plastic material can be brought at least partly on said surface and on the device, for example, between said surface and the device. The plastic material comprises an electrical conductor. Advantageously, an electrical flow can be initiated for conducting an electrical current through the electric conductor. Advantageously, the plastic material can be heated by the electric current flow. By this, the plastic material can be plastified. Embodiments may comprise one or more of the following. By heating or better by plastifying the plastic material, a sealing contact between the device and the surface of the conduit can be provided. The sealing contact can be realized, for example, as a chemical bond or alike.

For this purpose, the conduit/s and the device can but do not have to comprise a metal coat. The component parts can be coated with a coated material. Such a chemical bond can be realized, for example, between polyetheretherketone (PEEK) and metal, for example, chromium.

Plastifying can be understood in this application as heating the plastic material above its softening point, wherein the plastic material gets soft and/or melts. Besides this, the plastic material can be heated above its softening point and above its melting point for melting the plastic material.

Additionally, the plastic material can be brought between a surface of a second conduit and the device. Advantageously, by this the first conduit and the second conduit can be coupled via the plastic material and the device. Possibly, the device can comprise or provide the second conduit or in other words, such a coupling, for example, for a plurality of conduits, can be provided simply by the plastic material. Furthermore, the first and second conduits— or the plurality of conduits—can be brought in communication with each other, for example, in a fluidic communication.

The device can comprise a sleeve. Therefore, the plastic material can be brought between the surfaces of the first and/or second conduits and the sleeve. The first and/or second conduits can be introduced into an inner tube of the sleeve before adding the plastic material.

Advantageously, the plastic material can be heated locally adjacent to said surfaces of the first and/or second conduits. By this, any undesired flow of the plastic material during the heat treatment can be avoided or at least reduced to a minimum.

Embodiments may comprise one or more of the following. The surfaces of the first and second conduits can be surrounded by a preformed part adapted to the shapes of the first and/or second conduits. Advantageously, the device can comprise the preformed part. By this, the device can realize a forming tool and/or a housing. Consequently, the plastic material can be surrounded by the device realizing the forming tool and/or the housing. The device comprising the forming tool can comprise a mold adapted for forming the shape of the plastic material. By this, the plastic material itself can realize a coupling for the first and second conduits.
The device comprising the forming tool can be removed after transforming the coupling or rather after transforming the plastic material into the coupling.

[0021] The plastic material to be heated locally, for example, close to the electric conductor, can be cooled down to ambient temperature after being heated. By this, advantageously, the plastic material can be shrunk onto the surfaces of the first and/or second conduits. For this purpose, outer surfaces of the first and/or second conduits can be surrounded by the plastic material before starting the heat treatment and the cooling process.

[0022] Embodiments may comprise one or more of the following. The plastic material can realize a preformed part equipped with the electric conductor. In other embodiments, the plastic material can be provided as a granular or powder material and can be equipped with the electric conductor. For fritting the granular material, the plastic material can be heated above its softening temperature for plastifying it. A preformed part comprising the plastic material can be heated partly above its softening temperature. Advantageously, the plastic material can be heated at a contact zone at the surfaces of the first and/or second conduits and the plastic material. For realizing the sealing contact between the surfaces of the conduits and the plastic material ... The plastic material can comprise a wave guide. The second conduit can comprise a capillary and can be adapted for conducting a liquid or a gas.

[0026] The wave guide can be realized as a single mode or monomode glass or polymer fiber/s, fiber bundles, liquid light guide/s like Teflon AF® coated or refraction index modified capillaries, photonic bandgap fibers, and/or alike.

[0027] The second conduit can comprise a capillary, a glass capillary, a fused silica capillary, an analytical separation column, and/or alike.

[0028] The plastic material can comprise a thermoplastic material, polyetheretherketone (PEEK), one of a broad range of fluoropolymers, in particular perfluoroamines (PFA) or fluorinated ethylene-propylene copolymer (FEP), duroplastic material or compound, in particular polyimide, liquid crystal polymers (LCP), and/or alike.

[0029] Embodiments may comprise one or more of the following. The surface of at least one of the first and/or second conduits can be surrounded with the plastic material comprising the conductor. By this, a simple coupling for just one conduit can be realized. Besides this, two conduits can be coupled by the plastic material. For this purpose, the second conduit is the device.

[0030] Besides this, two conduits can be coupled by surrounding the surfaces of the first and second conduits instead of bringing the plastic material between the surfaces and an additional device. For this purpose, said additional device is not necessary. The plastic material can be produced, for example, as a preformed part provided with the electric conductor. The conduit or the conduits can be pre-assembled with the preformed part. Thereafter, the electric current can be initiated in the electric conductor for at least partly heating the plastic material of the pre-formed part for fixing the plastic material with the conduit or conduits, and for realizing the coupling. By providing just one conduit with the preformed part, a fitting for a conduit can be realized. Advantageously, a plurality of more than said two conduits can be coupled in the same way.

[0031] According to further embodiments of the invention, an arrangement of a coupling for coupling a first conduit to a device is suggested. The first conduit is adapted for conducting a medium and comprises a surface. The coupling comprises a coupling element. The coupling element can be adapted for coupling, connecting, sealing, fixing, adjusting, aligning, receiving, protecting, and/or positioning said first conduit. The coupling element comprises a plastic material comprising an electric conductor. The plastic material is attached to the outer surface of the first conduit.

[0032] Embodiment may comprise one or more of the following. The plastic material can be arranged between the surface and the device. The plastic material was at least partly heated above its softening point and/or its melting point by initiating an electric current flow through the electric conductor. By this, the coupling can be easily produced. Besides this, a sealing contact between the plastic material and the surface of the first conduit can be realized. In other words, the plastic material is attached to the surface of the first conduit. The plastic material can comprise a
preformed part adapted to the shapes, for example, the outer shapes of the first and/or second conduits.

Besides this, the plastic material can be surrounded with a forming tool and/or a housing. The housing can protect the coupling. The forming tool can comprise a mold adapted for forming the shape of the plastic material. Possibly, the forming tool can be removed after forming and/or producing the coupling. For realizing a good sealing contact, the plastic material can be shrunk onto the surfaces of the first and/or second conduits. By this, the coupling can be connected with the first and/or second conduits by a chemical bond and/or frictional forces. Possibly, the plastic material was just heated at a contact zone at ends of said first and/second conduits and the plastic material. By this, the solid plastic material realizes a surrounding for the part of the plastic material that was plastified, melted, and/or heat treated. In other words, the plastic material was heat treated locally adjacent to the electric conductor.

The electric conductor can be molded or embedded within the plastic material. By this, the plastic material and the electric conductor can realize a pre-formed part. The pre-formed part can simply be assembled with the first and/or second conduits before attaching the pre-formed part to the first and/or second conduits by inducing the electric current flow in the electric conductor. The electric conductor can comprise an electric wire. Possibly, the electric conductor can be produced by using chemical, electrochemical or mechanical processes or combination of these processes for example PVD or CVD. Besides this, the plastic material can be conductive itself and therefore realize the electric conductor.

Embodiments may comprise one or more of the following. The plastic material can comprise an aperture coupled to the first and/or second conduits. Besides this, the aperture can be coupled to a supplying conduit. The supplying conduit can easily realized as a bore leading into the second conduit.

Embodiments may comprise one or more of the following. The coupling, for example, a coupling between the first conduit and the second conduit, can be simply realized with the plastic material, wherein the plastic material at least partly surrounds the surfaces of the first and second conduits for realizing a fluid and/or light tight coupling. By this, an additional device is not necessary. The plastic material attached to the first and second conduits can realize the coupling.

According to further embodiments of the invention, a fluidic system adapted for analyzing a fluid is suggested. The fluidic system comprises a flow cell for housing a fluid sample and for exposing the fluid sample to radiation for analysis. The flow cell comprises a fluid path comprising a capillary adapted for conducting said fluid sample, and a light path comprising a light guide. The light path and the fluid path are coupled by a coupling comprising a plastic material and an electric conductor. Advantageously, the coupling of the flow cell can comprise a fluid- and/or light-tight seal at a coupling point of the fluid and the light path. The seal can be easily produced by conducting an electric current through the electric conductor.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and many of the attendant advantages of embodiments of the present invention will be readily appreciated and become better understood by reference to the following more detailed description of embodiments in connection with the accompanied drawings. Features that are substantially or functionally equal or similar will be referred to by the same reference signs.

FIG. 1 shows a three-dimensional top view of a part of a fluidic system comprising a flow cell comprising an arrangement of a coupling for a first and a second conduit.

FIG. 2 shows a longitudinal view of the partly shown fluidic system of FIG. 1,

FIG. 3 shows a detailed view of the arrangement of a coupling of the FIG. 1 and 2,

FIG. 3A shows a detailed view of an arrangement of a coupling comprising additional sleeves,

FIG. 3B shows a detailed view of an arrangement of a coupling comprising additional outer sheathings,

FIG. 3C to 3K show different cross-sectional views of the couplings of the FIG. 3A and 3B taken along the lines CD-CD, EF-EF, GH-GH, JJ-JJ, and KK of the FIG. 3A and 3B,

FIG. 4 shows a bottom view of the arrangement of a coupling of the FIG. 1 to 3,

FIG. 5 shows an inner view of a half shell of the arrangement of a coupling of the FIG. 1 to 4,

FIG. 6 shows a three-dimensional inner view of the half shell of FIG. 5, and

FIG. 7 shows a three-dimensional bottom view of the half shell of FIG. 5, and

FIG. 8 shows a fluidic system with two flow cells.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows an arrangement 1 of a coupling 3 for a first conduit 5 and a second conduit 7. The arrangement 1 is part of a flow cell 9 adapted for housing, conducting, and irradiating a fluid for analyzing purposes. The flow cell 9 is shown partly in FIG. 1 and is part of a fluidic system 11. The fluidic system 11 is adapted for analyzing a fluid, for example, a liquid comprising a sample.

The coupling 3 comprises a cubically shaped coupling element 13. The coupling element 13 comprises a plastic material 15 comprising a first electric conductor 17, a second electric conductor 19, and a third electric conductor 21. The electric conductors 17, 19, and 21 each comprise two electrical contacts 21. The first, second, and third electric conductors 17, 19, and 21 are embedded in the plastic material 15 of the coupling element 13, wherein the ends of the electric conductors 17, 19, and 21 are not embedded in the plastic material 15 and realize the contacts 21.

The first and second conduits 5 and 7 lead into the coupling element 13 of the coupling 3. The plastic material 15 of the coupling element 13 surrounds the ends of the first and second conduits 5 and 7. The plastic material 15 of the coupling element 13 is attached to said ends of the first and second conduits 5 and 7, for example, by a chemical bond,
by shrinking the plastic material 15 of the coupling element 13 onto the ends of the first and second conduits 5 and 7, and/or alike.

[0053] FIG. 2 shows a longitudinal view of the partly shown flow cell 9 of FIG. 1. The coupling element 13 of the coupling 3 is provided with a bore 25 realizing a supplying conduit 27 for the flow cell 9. The bore 25 of the coupling element 13 is connected to a stepped bore 27. The stepped bore 27 comprises a part of the supplying conduit 27 of the flow cell 9 and realizes a fitting 31 adapted for connecting the supplying conduit 27 of the flow cell 9 to a not shown fluid source or sink, for example, a pump or a waste. The flow cell 9 comprises a base plate 33 adapted for stabilizing, connecting, and/or protecting the parts of the flow cell 9. The base plate 33 comprises a part of the supplying conduit 27, the stepped bore 29, and the fitting 31.

[0054] Additionally, in embodiments the coupling element 13 can be surrounded with a housing 35 and/or a forming tool 37. The contour of the housing 35 and/or the forming tool 37 is indicated in FIG. 2 by an interrupted rectangle. The housing 35 can surround the plastic material 15 of the coupling element 13 for protecting the coupling 3. The forming tool 37 can be adapted for forming the shape of the coupling element 13.

[0055] FIG. 3 shows a detailed view of the coupling 3 of FIG. 2. The first conduit 5 of the arrangement 1 comprises a wave guide 39 comprising an optical outlet 31. The second conduit 7 of the arrangement 1 comprises a capillary 43 comprising a fluidic outlet 45. The coupling element 13 comprises an aperture 47 adapted for receiving the ends of the wave guide 39 and the capillary 43. The aperture 47 is realized as a stepped bore 49. The first and second conduits 5 and 7, or the wave guide 39 and the capillary 43, can be inserted into the stepped bore 49, wherein the optical outlet 41 is inserted so deep into the stepped bore 39 that the optical outlet 31 of the wave guide 39 is inserted into the fluidic outlet 45 and consequently into an inner tube 51 of the capillary 43. The outer dimension of the wave guide 39 is smaller than the inner diameter of the fluidic outlet 43, so that a circular gap remains and the fluidic outlet of the capillary 43 is not plugged completely by the inserted wave guide 39. The fluidic outlet 45 of the capillary 43 is coupled to the supplying conduit 27 of the flow cell 9 via the stepped bore 49 of the coupling element 13, the bore 25 of the coupling element 13, and the stepped bore 29 of the base plate 33 of the flow cell 9. For this purpose, the bore 25 of the coupling element 13 leads into the aperture 47 or better the stepped bore 49 of the coupling element 13. The inner diameter of the stepped bore 49 at the coupling point to the bore 25 can be the same as the inner diameter of the inner tube 51 of the capillary 43. This makes an optimal flow within the aperture 47 and the inner tube 51 possible.

[0056] The coupling element 13 can be attached to any device, for example, the base plate 33 by initiating an electric current through the first electric conductor 17. By this, the plastic material 15 of the coupling element 13 can be plastified or melted at least near the electric conductor 17. By this, a sealing contact between the base plate 33 and the coupling element 13 can be provided.

[0057] FIG. 3A shows another embodiment of a coupling 3A.

[0058] FIG. 3C shows a cross-sectional view of the coupling 3A of the FIG. 3A taken along the line CD-CD of the FIG. 3A, FIG. 3D shows the same cross-sectional view of the coupling 3A, but without the wave guide 39 and the capillary 43.

[0059] FIG. 3E shows a cross-sectional view of the coupling 3A of the FIG. 3A taken along the line EF-EF of the FIG. 3A. FIG. 3F shows the same cross-sectional view of the coupling 3A, but without the wave guide 39.

[0060] In difference to the coupling 3 as shown in FIG. 3, the coupling 3A comprises a first sleeve 52 and a second sleeve 54 inserted into the aperture 47 of the coupling 3A. The first sleeve 52 surrounds the capillary 43 and the second sleeve 54 the wave guide 39. The sleeves 52 and 54 can be, for example, a press-fit or a loose-fit within the aperture 47. The sleeves 52 and 54 can comprise the same thickness as the first and second electric conductors, for example, provided by metal sleeves 72.

[0061] The aperture 47 of the coupling 3A comprises steps 58 as high as the thickness of the sleeves 52 and 54, and the first and second electric conductors provided by the metal sleeves 72. By this, a gap remains between the outer surfaces 63 of the first and second conduits 5 and 7 adapted for receiving the sleeves 52 and 54, and the first and second electric conductors or better the metal sleeves 72 in a press-fit or loose-fit manner. Advantageously, the sleeves 52 and 54 can avoid any undesired flow of the plastic material when heated by the conduits. For this purpose, the sleeves 52 and 54 can comprise a non-conductive material. By this, an electric current flow can be induced in the conductors 19 and 21 without inducing an electric current flow in the sleeves 52 and 54. The span of the plastic material 15 heated by the first and second conductors 19 and 21 surrounding the capillary 43 of the coupling 3A is exemplarily indicated by dotted lines 60. The plastic material 15 can be melted and/or plastified within said span indicated by the lines 60.

[0062] As a further difference, the coupling 3A is coupled to the supplying conduit 27 via a third conduit 62, for example, a fused silica capillary. The third conduit 62 can be coupled to the coupling 3A via a third electric conductor 21, for example, provided by a metal sleeve. For preventing any undesired flow of the melted plastic material 15, the metal sleeve of the third conductor 21 can be mounted behind a third non-conducting sleeve, for example, a ceramics sleeve within the bore 25 of the coupling 3A, wherein the bore 25 also comprises a step 58.

[0063] Finally, as a difference, the body of the coupling 3A comprising the plastic material 15 is realized as an integral part, as shown in the FIG. 3C to 3F. The aperture 47 can, for example, realized by a stepped bore or can be produced by an injection molding process.

[0064] FIG. 3B shows another embodiment of a coupling 3B.

[0065] FIG. 3G shows a cross-sectional view of the coupling 3B of the FIG. 3B taken along the line GH-GH of the FIG. 3B. FIG. 3H shows the same cross-sectional view of the coupling 3B, but without the wave guide 39 and the capillary 43.

[0066] FIG. 3I shows a cross-sectional view of the coupling 3B of the FIG. 3B taken along the line HI-HI of the FIG. 3B. FIG. 3J shows the same cross-sectional view of the coupling 3B, but without the wave guide 39.
FIG. 3K shows a cross-sectional view of the coupling 3B of the FIG. 3B taken along the line K-K of the FIG. 3B. The coupling 3B comprises walls 66 comprising the plastic material 15 and a forking 68. The aperture 47 of the coupling 3B is provided by the circular walls providing a tube 70 adapted for receiving the first and second conduits 5 and 7. The circular shape of the walls 66 is shown in the FIG. 3G to 3K. The bore 25 is also surrounded by the plastic material 15. The coupling 3B provides a t-piece, wherein the bore 25 ends up in the tube 70 or better in the aperture 47 of the coupling 3B. The third conduit 62 is inserted into the bore 25.

For coupling the conduits 5, 7, and 62 into the aperture and the bore 25, the walls 66 can be circularly shaped and be surrounded by the first, second and third electric conductors, for example, provided by metal sleeves 72. The plastic material 15 of the walls 66 of the coupling 3B can be heated at least partly by initiating an electric current flow in the metal sleeves 72 surrounding the walls 66. Advantageously, the plastic material 15 can be heated for plastifying and/or melting. The zones of heat treated plastic material 15 are indicated by the dotted lines 60. Advantageously, said spans reach up to the surfaces of the conduits 5, 7, and 62 of the coupling 3B. By this, a sealing contact of the plastic material 15 with the surfaces of the conduits 5, 7, and 62 can be provided. The sealing contact zones surround the surfaces of the conduits 5, 7, and 62.

For avoiding any displacement of the walls 66 in a span between the ends of the coupling 3B and the heat treated zones of the plastic material 15, the outer sides of the walls 66 can be equipped with non-conducting sheathings 74 as exemplarily illustrated in FIG. 3B on the left hand side and on the bottom side. The sheathings 74 each can comprise a step providing a limit stop for the sleeves 72 of the circular electric conductors of the coupling 3B. By frictional forces and by the limit stop, each sheathing 74 can prevent any undesired displacement of the walls 66 while the heat treatment of the plastic material 15. Besides this, the sheathings 74 can be screwed with the walls 66. For increasing the frictional forces, the sheathing can comprise a span 78 being in a frictional contact with the outer surface of the walls 66, wherein the according electric conductor is arranged between the limit stop provided by the step 76 and said span 78. The span 78 is indicated in FIG. 3B by dotted lines. By this, the sheathing holds the electric conductor and the plastic material 15 in place. Furthermore, the sheathing 74 can be screwed together with the according wall 66. For this purpose, the span 78 and the wall 66 can comprise according threads 80.

FIG. 4 shows a bottom view of the coupling 3 of FIG. 3. FIG. 5, 6, and 7 show different views of a bottom half shell 57 of the coupling element 13.

For realizing the sealing contact between the coupling element 13 and the base plate 33 of the flow cell 9, the first electric conductor is circular-shaped ramified. Therefore, the first electric conductor 17 comprises a circular-shaped enlargement 53 comprising a circular recess 55, wherein the bore 25 is centrally arranged to the recess 55 of the first electric conductor 17. The first electric conductor 17 can be realized, as shown in FIG. 4, as a stripe, for example, as a metal stripe. Possibly, the first electric conductor can be realized as a wire or can be realized by an electrochemical treatment of the plastic material 15 of the coupling 13.

The plastic material 15 can be heated by the first electric conductor in a manner that the function of the bore 25 is not impaired. This can be achieved, for example, by a short process time of the heat treatment, by cooling the bore 25, for example, by leading a cold fluid through the bore 25, and or by heating the plastic material 15 of the coupling element 13 in a temperature range between the softening point and the melting point.

The coupling element 13 of the coupling 3 can comprise the bottom half shell 57 and an according top half shell 59, as visible in FIG. 3. The half shells 57 and 59 can be put together for providing the complete coupling element 13. The half shells 57 and 59 can be joined by initiating an electric current through the second and third electric conductors 19 and 21. The second and third electric conductors 19 and 21 are ramified and each comprises an enlargement 61. The enlargement 61 of the second and third electric conductors 19 and 21 is rectangularly shaped. The enlargements 53 and 61 of the electric conductors 17, 19, and 21 can comprise any shape, for example oval, polygon, and or alike. The second and third electric conductors 19 and 21 together surround the outer surfaces 63 of the first and second conduits 5 and 7. As shown in FIG. 5, the outer surfaces 63 are partly surrounded right and left—in direction of FIG. 5—of a coupling point 65 or better of the bore 25 of the supplying conduit 27 for realizing a fluid-tight seal for the fluid conducted within the flow cell 9. The fluid-tight seal can be produced by initiating an electric current in the second and third electric conductors 19 and 21 after putting together the top half shell 59 and the bottom half shell 57. By initiating the electric current, the plastic material 13 of the half shells 57 and 59 can be plastified and/or partly melted near the outer surfaces 63 of the first and second conduits 5 and 7 surrounded by the electric conductors 19 and 21. This results in said fluid-tight seal, wherein the fluid lead within the flow cell 9 is kept within a span of a recess 67 of the enlargement 61 of the second and third electric conductors 19 and 21.

In the following, a method of coupling a first conduit to a device is described by referring to the FIG. 1 to 7.

The first conduit 5 can be coupled to the base plate 33 of the flow cell 9 by at least partly bringing the plastic material 15 of the coupling element 13 between a surface 69 of the base plate 33 and the surface 63 of the first conduit 5. The plastic material 15 comprises the first electric conductor 17. For coupling the first conduit 5 with the base plate 33, an electric current can be initiated in the first electric conductor 17. By this, the plastic material 15 can be heated at least partly for plastifying and/or melting the plastic material 15. Advantageously, by this the plastic material 15 can be attached to the surface 69. In embodiments, the first and second conduits can be surrounded with the plastic material 15, but without the intention of coupling the coupling element 13 to a further device, for example, the base plate 33. The first and second conduits 5 and 7 can be sealed and coupled to each other by initiating an electric current within the second and third electric conductors 19 and 21. For this purpose, the plastic material 15 partly surrounds the
outer surfaces 63 of the first and second conduits 5 and 7 before initiating the electric current flow in the second and third electric conductors 19 and 21. For this purpose, the first and second conduits 5 and 7 can be inserted into the aperture 47 of the coupling element 13. Advantageously, the first and second conduits 5 and 7 can be brought in communication with each other.

[0076] FIG. 8 shows a fluidic system 201 comprising a fluid source 203, for example a pump, a nanopump, and/or alike, and a fluid sink 205, for example a waste or a downstream coupled device, for example for analysis purposes.

[0077] Between the fluid source 203 and the fluid sink 205, the fluidic system 201 comprises a fluid path 207. The fluid path 207 is coupled with at least one light path 209. Possibly, the fluid path 207 of the fluidic system 201 can be coupled with a second light path 211. The fluid path 207 and the first and second light paths 209 and 211 belong to a first and a second flow cell 213 and 215.

[0078] For coupling the fluid path 207 and the first and second light paths 209 and 211, the fluidic system 201 comprises at least one coupling 217. The coupling 217 can be realized according to one of the couplings according to the Figures above.

[0079] Each of the flow cells 213 and 215 comprises a capillary 219 and comprises a wave guide 221. The capillaries 219 of the first and second flow cells 213 and 215 are adapted for conducting a fluid, for example, a fluid comprising a sample, for example, a sample dissolved in a liquid. For analyzing the sample of the fluid, the fluid can be irradiated by the wave guides 221 of the light paths 209 of the first and second flow cells 213 and 215. For measuring the amount of light guided through the fluid sample, the light paths 209 can be connected to not shown light detectors.

[0080] Furthermore, the coupling/s 217 can comprise a plurality of communicating branches, for example, for coupling the capillaries 219, the wave guides 213, and/or according supplying or rather draining conduits to each other.

[0081] The direction of the light guided though the light paths 209 of the first and second flow cells 213 and 215 are indicated by arrows 225. The direction of the fluid guided though the fluid paths 207 of the first and second flow cells 213 and 215 are indicated by arrows 225. Besides this, different beams of the light paths 209 are indicated by lines 231.

[0082] The capillaries 219 of the first and second flow cells 213 and 215 can comprise a transparent material, for example glass, quartz glass, and/or alike, wherein the walls of the capillaries total reflection can occur as shown by the beams as indicated by the lines 231 of FIG. 8.

[0083] The fluid source 203 can comprise a separating device 227 and/or can be coupled with such a device. Besides this, the fluid sink 205 can comprise an analyzing device 229, for example, a mass spectograph. The fluidic system 201 can be realized as an integrated system for analysis purposes, for example as a integrated system commercially available, for example, a chromatographic system (LC), a high performance liquid chromatographic (HPLC) system, an HPLC arrangement comprising a chip and an mass spectograph (MS), a high throughput LC/MS system, a purification system, a micro fraction collection/spotting system, a system adapted for identifying proteins, a system comprising a GPC/SEC column, a nanoflow LC system, and/or a multidimensional LC system adapted for separation of protein digests.

[0084] The fluidic system 201 can be adapted for analyzing liquid. More specifically, the fluidic system 201 can be adapted for executing at least one microfluidic process, for example an electrophoresis and/or a liquid chromatographic process, for example a high performance liquid chromatographic process (HPLC). Therefore, the fluidic system 201 can be coupled to a liquid delivery system, in particular to a pump, and/or to a power source. For analyzing liquid or rather one or more components within the liquid, the fluidic system 201 can comprise a detection area, such as an optical detection area and/or an electrical detection area being arranged close to a flow path within the fluidic system 201. Otherwise, the fluidic system 201 can be coupled to a laboratory apparatus, for example to a mass spectrometer, for analyzing the liquid. For executing an electrophoresis, the flow path can comprise a gel. Besides this, the fluidic system can be a component part of a laboratory arrangement.

[0085] It is to be understood, that this invention is not limited to the particular component parts of the devices described or to process steps of the methods described as such devices and methods may vary. It is also to be understood, that different features as described in different embodiments, for example illustrated with different Fig., may be combined to new embodiments. It is finally to be understood, that the terminology used herein is for the purposes of describing particular embodiments only and it is not intended to be limiting. It must be noted, that as used in the specification and the appended claims, the singular forms of “a”, “an”, and “the” include plural referents until the context clearly dictates otherwise. Thus, for example, the reference to “a coupling” or “a fluid path” may include two or more such functional elements.

What is claimed is:

1. A method of coupling a first conduit to a device, wherein the first conduit comprises a surface and is adapted for conducting a medium, the method comprising:

   - at least partly bringing a plastic material on said surface and on said device, wherein the plastic material comprises an electric conductor,
   - initiating an electric current flow through said electric conductor of the plastic material,
   - at least partly heating said plastic material by said electric current flow for at least plastifying said plastic material.

2. The method of claim 1, comprising:

   - at least partly bringing a plastic material between said surface and said device,
   - at least partly bringing said plastic material between a surface of a second conduit and said device,
   - coupling said first and second conduits for bringing said conduits in communication with each other,
   - bringing said plastic material between said surface/s and a sleeve of said device,
   - heating said plastic material adjacent to said surface/s.
3. The method of claim 2, comprising at least one of:
  surrounding said surface/s with a preformed part adapted to the shapes of said first and second conduits,
  surrounding said surface with an additional sleeve,
  placing said additional sleeve adjacent to said electric conductor,
  surrounding said plastic material with said electric conductor,
  surrounding said electric conductor with an additional sheathing,
  screwing said sheathing with said plastic material,
  surrounding said surface/s with said device, wherein said device comprises said preformed part,
  surrounding said plastic material with said device, wherein said device comprises at least one of: a forming tool, a housing,
  said pre-formed part comprises said plastic material and said electric conductor,
  at least partly bringing said plastic material between a surface of a plurality of conduits and said device.
4. The method of claim 1, comprising at least one of:
  heating said plastic material at least partly above its softening temperature for plastifying said plastic material,
  heating said plastic material at least partly above its melting temperature for melting said plastic material,
  heating said plastic material at a contact zone at said surface of an end of said first conduit and said plastic material,
  molding said electric conductor in said plastic material,
 said electric conductor comprising at least one of: an electric wire, an electrically conducting strip, a metal strip, a metal sleeve, a metal part,
conducting an electric current through said electric conductor by inducing said current,
conducting an electric current through said electric conductor by connecting it to a power supply.
5. The method of claim 1, comprising at least one of:
cooling said plastic material down to ambient temperature.
shrinking said plastic material onto said surface of said first conduit.
6. The method of claim 1, comprising at least one of:
equipping said surface with said electric conductor before equipping said surface with said plastic material,
equipping said surface with a powder or granular material of said plastic material,
equipping said surface with a powder or granular material of said plastic material after equipping said outer surface with said electric conductor,
equipping said plastic part with said electric conductor whereas the electric conductor/s are not in contact with the conduits,
equipping said plastic material with said electric conductor by using chemical, electrochemical or mechanical processes or combination of these processes for example PVD or CVD.
7. The method of claim 2, comprising at least one of the following:
inserting an outlet of said first conduit into an outlet of said second conduit,
said outlet of said first conduit is an optical outlet and said outlet of said second conduit is a fluid outlet.
8. The method of claim 1, wherein the medium is at least one of: light, a liquid, a gas, and wherein said first conduit is at least one of the following:
a light guide, in particular single mode or multimode glass or polymer fiber/s, fiber bundles, liquid light guide/s like Teflon AF coated or refraction index modified capillaries, photonic bandgap fibers.
9. The method of claim 2, wherein the medium is at least one of: light, a liquid, a gas, and wherein said second conduit is at least one of the following:
a capillary,
a glass capillary,
a fused silica capillary,
liquid light guide/s like Teflon AF coated or refraction index modified capillaries, photonic bandgap fibers,
an analytical separation column.
10. The method of claim 1, wherein said plastic material is at least one of:
a thermoplastic material, polyetheretherketone (PEEK), one of a broad range of fluoropolymers, in particular perfluoroamines (PFA) or fluorinated ethylen-propylene copolymers (FEP), duroplastic material or compound, in particular polyimide, liquid crystal polymers (LCP).
11. The method of claim 1, comprising at least one of:
at least partly surrounding said surface with said plastic material comprising said electric conductor,
at least partly surrounding an surface of a second conduit with said plastic material comprising said electric conductor, wherein said second conduit is said device,
at least partly surrounding at least one of said first and second conduits with said plastic material supplementary or instead of bringing said plastic material between at least one of said surfaces and said device.
12. An arrangement of a coupling for coupling a first conduit to a device, comprising:
a coupling element adapted for at least one of: coupling, connecting, sealing, fixing, adjusting, aligning, receiving, protecting, positioning said first conduit,
an electric conductor,
wherein the first conduit is adapted for conducting a medium and comprises a surface, wherein said coupling element comprises a plastic material comprising said electric conductor, wherein said plastic material is arranged on said surface and on said device, wherein said plastic material was at least partly heated above at
least one of: its melting point, its softening point by, initiating an electric current flow through said electric conductor.

13. The arrangement of claim 12, comprising at least one of the following:

said plastic material is arranged between said surface and said device,
said plastic material is arranged adjacent to said surface,
said device comprises a second conduit,
said plastic material is a pre-formed part adapted to the shapes of said first conduit and said second conduit,
said plastic material is a pre-formed part adapted to the shapes of said first conduit and a plurality of conduits,
said plastic material is surrounded with at least one of: a forming tool, a housing,
said plastic material is shrank on said surface of said first and second conduits,
said plastic material was heated at a contact zone at said ends of said first and second conduits and said plastic material,
said plastic material is conductive and realizes said electric conductor.

14. The arrangement of claim 12, comprising at least one of the following:

said electric conductor is molded in said plastic material,
said electric conductor is inserted after molding or machining said plastic material,
said electric conductor comprises an electric wire molded in said plastic material,
electric conductor comprises an chemical, electrochemical or by mechanical processes or combination of these processes for example PVD or CVD produced electric conductor,
wherein said surface is equipped with said electric conductor, in particular said electric wire,

surrounding said surface is surrounded by an additional sleeve,
said additional sleeve is placed adjacent to said electric conductor,
said plastic material is surrounded by said electric conductor,
said electric conductor is surrounded by an additional sheathing,
said sheathing is screwed with said plastic material.

15. The arrangement of claim 12, comprising at least one of the following:

said outlet of said first conduit is inserted into said outlet of said second conduit,
said outlet of said first conduit is an optical outlet and said outlet of said second conduit is a fluid outlet,
said first conduit and a second conduit, wherein each conduit is adapted for conducting said medium and comprises an end with an outer surface adjacent to said outlet,

wherein said plastic material surrounds said surfaces of said first and second conduits,
said first conduit and a second conduit, wherein each conduit is adapted for conducting said medium and comprises an end with an outlet and an outer surface adjacent to said outlet.

16. The arrangement of claim 12, wherein the medium is at least one of:

light, a liquid, a gas, and wherein said first conduit is at least one of the following:
a light guide, in particular single mode or multimode glass or polymer fiber/s, fiber bundles, liquid light guide/s like Teflon AF coated or refraction index modified capillaries, photonic bandgap fibers,

17. The arrangement of claim 12, wherein the medium is at least one of:

light, a liquid, a gas, and wherein said second conduit is at least one of the following:
a capillary,
a glass capillary,
a fused silica capillary,
an analytical separation column.

18. The arrangement of claim 12, comprising at least one of the following:

said plastic material comprises an aperture coupled to said second conduit,
said aperture is coupled to a supplying conduit,
said aperture is a bore leading in said second conduit.

19. The arrangement of claim 12, wherein said plastic material is at least one of: a thermoplastic material, polyetheretherketone (PEEK), one of a broad range of fluoropolymers, in particular perfluoroaromatics (PFA) or fluorinated ethylen-propylene copolymer (FEP), duroplastic material or compound, in particular polyimide, liquid crystal polymers (LCP).

20. A fluidic system adapted for handling a fluid, comprising:
a coupling element adapted for at least one of: coupling, connecting, sealing, fixing, adjusting, aligning, receiving, protecting, positioning a first conduit,
an electric conductor,

wherein said first conduit is adapted for conducting a medium and comprises a surface, wherein said coupling element comprises a plastic material comprising said electric conductor, wherein said plastic material is arranged on said surface and on said device, wherein said plastic material was at least partly heated above at least one of: its melting point, its softening point, by initiating an electric current flow through said electric conductor.

21. The fluidic system according to claim 20 adapted for analyzing a fluid, wherein said fluidic system comprises a
flow cell for housing a fluid sample and for exposing said fluid sample to radiation for analysis, the flow cell comprising:

- a capillary adapted for conducting said fluid sample,
- a light path comprising said capillary, a first and a second light guide each adapted for conducting said light into and out of said flow cell,
- a fluid path comprising said capillary,
- a coupling comprising said coupling element, wherein said coupling is adapted for coupling said light path and said fluid path.

said coupling comprises a first branch coupled to one of said light guides, a second branch coupled to one end of said analysis capillary, and a third branch coupled to a supplying conduit.

22. The fluidic system according to claim 20, comprising at least one of the following:

- said plastic material is arranged between said surface and said device,
- two of said couplings,
- two of said flow cells,
- two of said flow cells coupled by one of said couplings,
- said couplings comprise each a plurality of communicating branches,
- a supplying conduit adapted for conducting said fluid sample into said capillary,

said flow cell comprises a housing for supporting, positioning, and surrounding said capillary and said couplings.

23. The fluidic system according to claim 20, further comprising:

- a fluid delivery system,
- a separation device for separating components of said fluid delivered by said fluid delivery system, and
- the flow cell adapted for detecting said separated components within said fluid.

24. The fluidic system according to claim 20, wherein said fluidic system is or comprises at least one of:

- a chromatographic system (LC),
- a high performance liquid chromatographic (HPLC) system,
- an HPLC arrangement comprising a chip and a mass spectrograph (MS),
- a high throughput LC/MS system,
- a purification system,
- a micro fraction collection/spotting system,
- a system adapted for identifying proteins,
- a system comprising a GPC/SEC column,
- a nanoflow LC system,
- a multidimensional LC system adapted for separation of protein digests.

* * * * *