

the gasket layer. Cover layer 1322 mates to cartridge body 1100 through gasket layer 1330 (preferably a double sided adhesive tape) to define conduit segments, such as 1060 shown in FIG. 10, that (via formation of double Z-transitions) act as bridge segments connecting the fluidic networks defined by cover layers 1324 and 1350. Advantageously, the use of a such a "bridge" cover layer allows cover layer 1350 having patterned electrodes (and, optionally, patterned binding reagents on the electrodes) to be only slightly larger than the patterned components. This arrangement decreases the cost of the patterned component. Alternatively, the bridge cover layer and associated double Z-transitions can be omitted and cover layers 1324 and 1350 can be combined into a single contiguous cover layer. Optionally, pill zones containing dry reagents pills are located on cover layer 1332 in the regions that are exposed by openings 1345 and 1346 in gasket 1330 so that they the reagents are reconstituted in liquids passing through the pill zones on the way to detection chambers 945 and 946. Cover layer 1321 seals air chamber/trap 976 and the top side conduit segments which include double Z-transition connecting segments 1070 and 1071. Cover layer 1320 seals sample introduction port 921 and reagent introduction port 922.

[0269] In the preferred embodiment shown in FIGS. 11 and 13, the cartridge body further includes electrical access regions 995 and 996 that, together with cutouts 1370 and 1371 in gasket layer 1331 allow electrical contact to be made with electrode contacts 997,998. Electrical access regions are cut-outs or holes in the cartridge body configured and arranged to be in alignment with the electrode contacts.

[0270] At least a portion of cartridge body 1100 is adapted and configured to be an optical detection window and is arranged in optical registration with the electrodes to allow optical detection of luminescence generated by the electrode array. In one particularly preferred embodiment, the cartridge body and/or the cover layers are fabricated from a translucent material. The use of optically transparent materials has the further advantage that optical detectors, e.g., detectors arranged within a cartridge reader, can be used to detect the presence of liquids in the conduits. These optical detectors can be used to ensure that the cartridge is functioning properly and to provide feedback to the control systems controlling fluid movement in the cartridge. Alternatively, the cartridge body and/or cover layers may contain optical detection windows that are properly arranged locations that require optical detection of fluid presence and/or composition (e.g., detection of reflectance/transmittance from a light source). FIG. 12 depicts preferred locations for optical detection points 1210-1217 in cartridge 900.

[0271] FIG. 14a is a schematic representation of the fluidic components of cartridge 1400, another preferred embodiment of the cartridge of the invention. FIGS. 14b and 14c show exploded views of one preferred design of cartridge 1400. FIG. 18 is a three dimensional representation of the fluidic network of this design. Cartridge 1400 comprises a sample chamber 1420, first and second reagent chambers 1425 and 1426, detection chambers 1445 and 1446, waste chambers 1430 and 1431. Sample chamber 1420 is preferably adapted to receive a liquid sample and is linked via vent conduit 1475 to vent port 1480 and via sample conduit 1415 (including sample conduit branches 1440 and 1441 that branch from distribution point 1540) to detection chambers 1445 and 1446. Vent conduit preferably has a serpentine shape to increase its length and prevent fluid from bubbles in

sample chamber 1420 from back-flowing into vent port 1480. Sample conduit 1415 preferably comprises a Z-transition near the conduit connection to the sample chamber 1420 for preventing premature leakage of sample from sample chamber 1420. Sample chamber 1420 also has sample introduction port 1416 and cap insert 1414 for sealing the port. Optionally, sample conduit branches 1440 and/or 1441 comprise reagent pill zones.

[0272] Reagent chambers 1425 and 1426 are, preferably, adapted to hold reagent ampoules. Reagent chamber 1425 is connected via a reagent vent conduit to vent port 1450 and via reagent conduit 1470 to sample conduit 1415. Reagent conduit 1470 is further connected via vent conduit 1482 to vent port 1481 which may be used to introduce air into reagent conduit 1470 and downstream conduits such as sample conduit branches 1440 and 1441. Advantageously, reagent conduit 1470 has an extended segment between vent conduit 1482 and sample conduit 1415 which may be used as a staging area for a defined volume of liquid reagent. Preferably, this extended segment also comprises a reagent pill zone for introducing a dry reagent into the liquid reagent held in reagent chamber 1425. Reagent chamber 1426 is connected via a vent conduit to vent port 1451 and via reagent conduit 1427 to sample conduit 1415 (first intersecting with reagent conduit 1470 just downstream from sample conduit 1415). Reagent conduits 1427 and 1470 preferably comprise Z-transitions near to the connection of the conduits to their corresponding reagent chambers to prevent premature leakage of the reagent from the chambers. Detection chambers 1445 and 1446 preferably, comprise immobilized binding reagents for analytes of interest, preferably an array of binding reagents, preferably an array of binding reagents supported on electrode arrays for conducting ECL measurements, e.g., the electrode arrays of the invention as described above. Detection chambers 1445 and 1446 connect to sample conduit branches 1440 and 1441 and to waste conduits 1460 and 1461. Waste chambers 1430 and 1431 connect to waste conduits 1460 and 1461 and, via vent conduits to vent ports 1452 and 1453. Optionally, one detection chamber (and the associated fluidics and waste chamber) may be omitted.

[0273] Cartridge 1400 is adapted to carry out one and two step washed assays (assays that involve treating a detection chamber with one or two samples/reagents prior to conducting a wash step). A preferred embodiment of a one step washed assay comprises: i) introducing sample from sample chamber 1420 into detection chambers 1445 and/or 1446 via sample conduit branches 1440 and/or 1441 (optionally, the sample introduced into the detection chambers including reconstituted reagents such as labeled binding reagents and/or control/calibration reagents picked up in pill zones comprised in sample conduit branches 1440 and/or 1441) ii) washing detection chambers with a wash reagent contained in reagent chamber 1426 (the reagent preferably comprising an electrochemiluminescence coreactant and providing a suitable environment for an ECL measurement) and iii) interrogating the contents of the detection chamber (preferably, by conducting an ECL measurement). For cartridges carrying out such a one step protocol, reagent chamber 1425 may be omitted (in which case, vent port 1481 may be directly connected to reagent conduit 1427 or sample conduit 1415. A preferred embodiment of a two-step washed assay comprises: i) introducing sample from sample chamber 1420 into detection chambers 1445 and/or 1446 via sample conduit branches 1440 and/or 1441 (optionally, the sample introduced into the