

interconnects the emitter mount 2210 and the cable connector 2230. A second plurality of conductors 2050 disposed on the circuit substrate 2200 electrically interconnects the detector mount 2220 and the cable connector 2230. A decoupling 2060 disposed proximate the cable connector 2230 substantially mechanically isolates the cable connector 2230 from both the emitter mount 2210 and the detector mount 2220 so that sensor cable stiffness is not translated to the emitter assembly 500 or the detector assembly 2400. A shield 2070 is adapted to fold over and shield one or more wires or pairs of wires of the sensor cable 4400.

[0087] FIG. 21 illustrates a flex circuit assembly 1900 having a flex circuit 2200, an emitter assembly 500 and a detector assembly 2400, which is configured to terminate the sensor end of a sensor cable 4400. The flex circuit assembly 1900 advantageously provides a structure that electrically connects yet mechanically isolates the sensor cable 4400, the emitter assembly 500 and the detector assembly 2400. As a result, the mechanical stiffness of the sensor cable 4400 is not translated to the sensor pads 3000, 3100 (FIGS. 30-31), allowing a comfortable finger attachment for the sensor 200 (FIG. 1). In particular, the emitter assembly 500 and detector assembly 2400 are mounted to opposite ends 2201, 2202 (FIG. 22) of an elongated flex circuit 2200. The sensor cable 4400 is mounted to a cable connector 2230 extending from a middle portion of the flex circuit 2200. Detector wires 4470 are shielded at the flex circuit junction by a fold-over conductive ink flap 2240, which is connected to a cable inner shield 4450. The flex circuit 2200 is described in further detail with respect to FIG. 22. The emitter portion of the flex circuit assembly 1900 is described in further detail with respect to FIG. 23. The detector assembly 2400 is described with respect to FIG. 24. The sensor cable 4400 is described with respect to FIGS. 44A-B, below.

[0088] FIG. 22 illustrates a sensor flex circuit 2200 having an emitter end 2201, a detector end 2202, an elongated interconnect 2204, 2206 between the ends 2201, 2202 and a cable connector 2230 extending from the interconnect 2204, 2206. The emitter end 2201 forms a "head" having emitter solder pads 2210 for attaching the emitter assembly 500 (FIG. 6) and mounting ears 2214 for attaching to the emitter pad 3000 (FIG. 30B), as described below. The detector end 2202 has detector solder pads for attaching the detector 2410 (FIG. 24). The interconnect 2204 between the emitter end 2201 and the cable connector 2230 forms a "neck," and the interconnect 2206 between the detector end 2202 and the cable connector 2230 forms a "tail." The cable connector 2230 forms "wings" that extend from the interconnect 2204, 2206 between the neck 2204 and tail 2206. A conductive ink flap 2240 connects to the cable inner shield 4450 (FIGS. 44A-B) and folds over to shield the detector wires 4470 (FIGS. 44A-B) soldered to the detector wire pads 2236. The outer wire pads 2238 connect to the remaining cable wires 4430 (FIGS. 44A-B). The flex circuit 2200 has top coverlay, top ink, inner coverlay, trace, trace base, bottom ink and bottom coverlay layers.

[0089] The flex circuit 2200 advantageously provides a connection between a multiple wire sensor cable 4400 (FIGS. 44A-B), a multiple wavelength emitter assembly 500 (FIG. 6) and a detector assembly 2400 (FIG. 24) without rendering the emitter and detector assemblies unwieldy and stiff. In particular, the wings 2230 provide a relatively large solder pad area 2232 that is narrowed at the neck 2204 and

tail 2206 to mechanically isolate the cable 4400 (FIGS. 44A-B) from the remainder of the flex circuit 2200. Further, the neck 2206 is folded (see FIG. 4) for installation in the emitter pad 3000 (FIGS. 30A-H) and acts as a flexible spring to further mechanically isolate the cable 4400 (FIGS. 44A-B) from the emitter assembly 500 (FIG. 4). The tail 2206 provides an integrated connectivity path between the detector assembly 2400 (FIG. 24) mounted in the detector pad 3100 (FIGS. 31A-H) and the cable connector 2230 mounted in the opposite emitter pad 3000 (FIGS. 30A-H).

[0090] FIG. 23 illustrates the emitter portion of the flex circuit assembly 1900 (FIG. 21) having the emitter assembly 500. The emitter assembly connector 1530 is attached to the emitter end 2210 of the flex circuit 2200 (FIG. 22). In particular, reflow solder 2330 connects thru hole pads 1532, 1534 of the emitter assembly 500 to corresponding emitter pads 2310 of the flex circuit 2200 (FIG. 22).

[0091] FIG. 24 illustrates a detector assembly 2400 including a detector 2410, solder pads 2420, copper mesh tape 2430, an EMI shield 2440 and foil 2450. The detector 2410 is soldered 2460 chip side down to detector solder pads 2420 of the flex circuit 2200. The detector solder joint and detector ground pads 2420 are wrapped with the Kapton tape 2470. EMI shield tabs 2442 are folded onto the detector pads 2420 and soldered. The EMI shield walls are folded around the detector 2410 and the remaining tabs 2442 are soldered to the back of the EMI shield 2440. The copper mesh tape 2430 is cut to size and the shielded detector and flex circuit solder joint are wrapped with the copper mesh tape 2430. The foil 2450 is cut to size with a predetermined aperture 2452. The foil 2450 is wrapped around shielded detector with the foil side in and the aperture 2452 is aligned with the EMI shield grid 2444.

#### Detector Assembly

[0092] FIG. 25 illustrates an alternative detector assembly 2400 embodiment having adjacent detectors. Optical radiation having multiple wavelengths generated by emitters 700 is transmitted into a tissue site 1. Optical radiation at a first set of wavelengths is detected by a first detector 2510, such as, for example, a Si detector. Optical radiation at a second set of wavelengths is detected by a second detector 2520, such as, for example, a GaAs detector.

[0093] FIG. 26 illustrates another alternative detector assembly 2400 embodiment having stacked detectors coaxial along a light path. Optical radiation having multiple wavelengths generated by emitters 700 is transmitted into a tissue site 1. Optical radiation at a first set of wavelengths is detected by a first detector 2610. Optical radiation at a second set of wavelengths passes through the first detector 2610 and is detected by a second detector 2620. In a particular embodiment, a silicon (Si) detector and a gallium arsenide (GaAs) detector are used. The Si detector is placed on top of the GaAs detector so that light must pass through the Si detector before reaching the GaAs detector. The Si detector can be placed directly on top of the GaAs detector or the Si and GaAs detector can be separated by some other medium, such as a transparent medium or air. In another particular embodiment, a germanium detector is used instead of the GaAs detector. Advantageously, the stacked detector arrangement minimizes error caused by pathlength differences as compared with the adjacent detector embodiment.