

[0047] Thin film photovoltaic device **20** may comprise first contact **8**, first semiconductor **6** disposed on first contact **8**, a second semiconductor **5** disposed on first semiconductor **6**, an interrupted, or otherwise patterned, second contact **4** disposed on second semiconductor **5**, and an absorber **2** disposed on second contact **5** and filling the interrupts or voids in the pattern in second contact **5**. Absorber **2** may comprise a p-type semiconductor and second semiconductor **5** may comprise the same or different p-type semiconductor. Alternatively, absorber **2** may comprise a n-type semiconductor and second semiconductor **5** may comprise the same or different n-type semiconductor. Second semiconductor **5** and absorber **2** may comprise the same materials or different materials. In the aspect of the photovoltaic device shown in FIGS. *2a* and *2b*, second contact **4** comprises a plurality of interconnected wires **3**, interrupted with spacing between the interconnected wires **3**, and electrically interconnected with contact pad **7**.

[0048] FIGS. *3a* and *3b* show photovoltaic device **30** with back contacts **4** and **8**. FIG. *3b* is a cross-sectional view of photovoltaic device **30** showing layers 'a'-'f'. Photovoltaic device **30** may be a thin film photovoltaic device and may comprise a first contact **8** disposed in a first layer 'a' and having an upper surface and a lower surface, as shown in FIG. *3b*. A semiconductor **6** may be disposed in a second layer 'b' and have a lower surface disposed on the upper surface of the first contact **8**. An insulator **11** may be disposed in a third layer 'c' and on an upper surface of the first semiconductor **6**. Insulator **11** may comprise, or consist of, most any electrical insulating material such as SiO<sub>2</sub>. Insulator **11** is configured and disposed to insulate electrical contact between semiconductor **6** and second contact **4**. In this aspect of the disclosure, insulator **11** may be in a form or shape like, or corresponding with, second contact **4**, partially filling layer 'c'. However it is to be understood that the insulator **11** may have a variety of configurations which insulate contact **4** from semiconductor **6**.

[0049] Second contact **4** may be disposed in a fourth layer 'd' and on insulator **11**. Absorber **2** may comprise a second semiconductor and may be disposed in a fifth layer 'e' and about second contact **4**, insulator **11**, and semiconductor **6**. Absorber **2** may be a semiconductor, for example a p-type or n-type semiconductor, and may completely fill layer 'e' and partially fill layers 'c' and 'd'.

[0050] Optionally, photovoltaic device **30** may comprise a substrate **9** in layer 'f'. Substrate **9** may be configured and disposed to have first contact **8** deposited thereon and support layers 'a'-'e'. In at least one aspect of the present disclosure, photovoltaic device **30** is void of substrate **9** and first contact **8** may be configured and disposed to support layers 'b'-'e', for example contact **8** may comprise a thick contact material. Second layer 'b' may be deposited on, disposed on, and/or adjacent to first layer 'a', third layer 'c' may be deposited on, disposed on, and/or adjacent to second layer 'b', fourth layer 'd' may be deposited on, disposed on, and/or adjacent to third layer 'c', and fifth layer 'e' may be deposited on, disposed on, and/or adjacent to fourth layer 'd'. In at least one aspect, photovoltaic device **30** has substrate **9** in layer 'f' and first layer 'a' may be deposited on, disposed on, and/or be adjacent with fifth layer 'f'.

[0051] FIG. *3a* shows a top view of photovoltaic device **30** having absorber **2** removed therefrom. In this respect, a portion of layer 'd' is shown having contact material **4** and a portion of layer 'b' is shown having semiconductor **6**. In this aspect, electrode or contact material **4** may comprise a group

of parallel wires **3**, which may be attached to each other by a contact pad **7**, thus forming the second electrode or contact **4**.

[0052] Thin film photovoltaic device **30** with back contacts **8** and **4** comprises a first contact **8** disposed in first layer 'a' and has an upper surface and a lower surface. Semiconductor **6** is disposed in second layer 'b' and has a lower surface disposed on the upper surface of the first contact **8**. An insulator **11** is disposed in a third layer 'c' and on an upper surface of the semiconductor **6**. Second contact **4** is disposed in a fourth layer 'd' and on insulator **11**. Absorber **2** completely fills fifth layer 'e' and is disposed about second contact **4** and insulator **11** within layers 'c' and 'd'. Second layer 'b' may be adjacent first layer 'a', third layer 'c' may be adjacent second layer 'b', fourth layer 'd' may be adjacent third layer 'c', and fifth layer 'e' may be adjacent fourth layer 'd'.

[0053] Absorber **2** of photovoltaic device **30** may comprise a p-type semiconductor or a n-type conductor and semiconductor **6** may comprise the other of the p-type semiconductor and n-type conductor. Insulator **11** may be disposed in third layer 'c'. Insulator **11** may have most any form and may be configured to insulate direct electrical communication between semiconductor **6** and second contact **4** and ensure electrical communication between first contact **8** and second contact **4** solely through semiconductor **6** and absorber **2**. Photovoltaic device **30** may comprise substrate **9** and first contact **8** may have its lower surface disposed on substrate **9**. Second contact **4** may have an interrupted pattern and thereby only partially fill fourth layer 'd' and absorber **2** may fill the interrupts in second contact **4**.

[0054] Photovoltaic device **30** may comprise a first electrode **8** disposed in first layer 'a', semiconductor **6** disposed in second layer 'b' on first electrode **8**, insulator **11** may have an interrupted pattern and may be disposed in third layer 'c' on semiconductor **6**, second electrode **4** may be disposed in fourth layer 'd' and only on insulator **11**, absorber **2** may entirely fill fifth layer 'e' and be disposed on second electrode **4** and may fill the interrupted patterns of insulator **11** and second electrode **4**. Insulator **11** may be comprised of a non-conducting or non-semiconducting materials. For example, insulator **11** may consist of SiO<sub>2</sub>. Absorber **2** may comprise a p-type semiconductor or a n-type conductor and semiconductor **6** may comprise the other of the p-type semiconductor and n-type conductor. The p-type material may be selected from the group consisting of: cadmium telluride, copper indium diselenide, copper indium gallium diselenide and copper oxide. The p-type material may be doped or undoped. The n-type material may be either cadmium sulfide or zinc oxide, and may be doped or undoped.

[0055] FIGS. *4a* and *4b* show photovoltaic device **40** with back contacts **4** and **8**. FIG. *4b* is a cross-sectional view of photovoltaic device **40** showing layers 'a'-'g'. Photovoltaic device **40** may be a thin film photovoltaic device and may comprise a first contact **8** disposed in a first layer 'a' and having an upper surface and a lower surface, as shown in FIG. *4b*. A first semiconductor **6** may be disposed in a second layer 'b' and in a portion of third layer 'c', and have a lower surface disposed on the upper surface of the first contact **8**. Insulator **11** may be disposed in a portion of fourth layer 'd' and on an upper surface of the first semiconductor **6**. Insulator **11** may comprise, or consist of, a non-electrically conducting material. Second contact **4** may be disposed in a portion of a fifth layer 'e' and on insulator **11**. Absorber **2** may comprise a semiconductor and may be disposed in a sixth layer 'f', and a portion of layers 'c', 'd', and 'e' and about second contact **4**,