ductive layer **190** and to achieve a desired sheet resistance, for example, a sheet resistance in the range of about 100 to 2000 ohms/square for resistive touch sensors, or 200 to 10,000 ohms/square for capacitive touch sensors, although other sheet resistances may be achieved as desired. The size and density of the voids may also be selected to achieve desired visual properties, such as a uniform appearance when a display is viewed through a touch screen incorporating a transparent conductive film containing such voids.

[**0030**] The touch sensor described in connection with **FIG. 1** may be used in a touch sensing system incorporating a controller. The controller provides energizing signals to the touch sensor and interprets signals from the touch sensor to determine a touch location. The touch sensor and controller together may be combined with a processor and/or a display.

[**0031**] Turning now to **FIG. 2**, there is shown an embodiment of a touch sensing system **100** using a high transparency etched touch sensor in accordance with an embodiment of the present invention. The touch sensing system **200** shown in **FIG. 1** includes a touch sensor **210** that is communicatively coupled to a controller **230**. In a typical configuration, the touch sensor **210** is used in combination with a display **220** of a computer system **240** to provide for visual and/or tactile interaction between a user and the computer system **240**. The touch sensor **210** and the display **220** may be arranged so that the display **220** is viewable through the touch sensor **210**.

[**0032**] The touch sensor **210** can be implemented as a device separate from, but operative with, the display **220** of the computer system **240**. Alternatively, the touch sensor **210** can be implemented as part of a unitary system which includes a display device, such as a light emitting diode display, a cathode ray tube display, a plasma display, a liquid crystal display, an electroluminescent display, static graphics, other type of display technology amenable to incorporation of the touch sensor **210**. It is further understood that the touch sensor **210** may be implemented as a component of a system defined to include only the touch sensor **210** and the controller **230** which, together, can implement a touch system of the present invention.

[**0033**] In the illustrative configuration shown in **FIG. 2**, communication between the touch sensor **210** and the computer system **240** is implemented via the controller **230**. The controller **230** is typically configured to execute firmware/software that provides for detection of touches applied to the touch sensor **210**. The controller **230** may alternatively be arranged as a component of the computer system **240**.

[**0034**] A method for manufacturing a high transparency touch sensor in accordance with an embodiment of the invention is illustrated in the flowchart of **FIG. 3**. According to this method, a substrate is provided **310**. A transparent conductive layer is disposed **320** on the substrate. Voids are formed **330** in the transparent conductive layer according to a random pattern. The density of the voids is selected to maintain the electrical continuity of the conductive layer.

[**0035**] In one embodiment, the transparent conductive layer is comprised of a conductive oxide such as ITO, ATO or TO. The voids may define apertures through the conductive layer or may form craters wherein the conductive layer is only partially penetrated by the void. The voids may be substantially circular, as illustrated in **FIG. 1**C, may be any shape. In one example, each void defines an area less than about 10,000 μm^2.

[**0036**] The voids are formed so that their density and arrangement maintains the physical and electrical continuity of the conductive layer and may be used to achieve a desired sheet resistance. In one example, a low sheet resistance film is deposited and the selected areas of the film are removed to achieve the desired sheet resistance. For sake of non-limiting example, a conductive film having a sheet resistance in the range of about 5 to 10 ohms/square may be deposited. Voids are formed in the conductive film to achieve a desired sheet resistance, for example, a sheet resistance in the range of about 300 to 500 ohms/square. In some applications, the size, density, and arrangement of the voids may be selected so that the surface of the touch sensor presents an acceptably uniform appearance.

[**0037**] According to one embodiment, the voids are formed in a random pattern by laser ablation. The conductive layer can be directly ablated, or ablation may be enhanced or assisted by disposing a "blow-off" layer between the conductive layer and the substrate or on top of the conductive layer. The "blow-off" layer is formed of a material suitable for absorbing laser radiation to facilitate the formation of the voids. Suitable ablation assisting or enhancing layers include metals and other materials such as disclosed in U.S. Pat. No. 6,485,839.

[**0038**] In another embodiment, formation of the voids is accomplished by selective etching. The etchant resist may be patterned on the conductive layer using photolithographic techniques, ink jet printing or other patterning methods. Alternatively, an etchant may be selectively deposited directly via printing techniques.

[**0039**] According to yet another embodiment, particles of appropriate size are randomly deposited on the substrate. A conductive material is deposited on the substrate so that the conductive material surrounds the particles, forming an electrically continuous conductive layer. The particles are removed from the substrate leaving voids in the conductive layer. The conductive material may be back etched to expose the particles for removal.

[**0040**] In addition to the substrate and conductive layer, a method for manufacturing a touch sensor in accordance with an embodiment of the invention may further include the formation of one or more dielectric layers and/or protective layers coupled to the transparent conductive layer and the substrate.

[**0041**] A process of manufacturing a capacitive touch sensor may further include forming a protective layer over the conductive layer containing the voids. A sufficiently thin protective layer may conform to the structure created by the voids, thus providing a roughened surface. Such a roughened protective layer may be useful for providing anti-glare properties, provided the depth of the voids is sufficient so that the coated protective layer has a surface roughness sufficient for reducing glare. Surface roughnesses of around 100 nm may be sufficient for reducing glare. If the conductive layer itself is not thick enough to allow formation of sufficiently deep voids, an additional layer or layers may be disposed on the conductive layer or between the conductive layer and the substrate. Voids can then be formed that penetrate both the conductive layer and the additional layer(s) so that a desirable depth is achieved.

[**0042**] A process for manufacturing a resistive touch sensor may further include forming a second transparent con-