BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a humidity sensor in accordance with the applicants' invention at an early stage in the fabrication process to show certain internal features;

FIG. 2 is a perspective view of the humidity sensor of FIG. 1 at a later stage in the fabrication process to show other internal features;

FIG. 3 is a cross-sectional view through the humidity sensor of FIGS. 1 and 2 at a yet later stage in the fabrication process;

FIG. 4 is an external perspective view of the humidity sensor of FIGS. 1–3;

FIGS. 5 and 6 are perspective views of other substrate configurations suitable for use in the applicants' humidity sensor;

FIG. 7 is a block diagram of a dew point hygrometer system using the humidity sensor of the applicants' invention;

FIG. 8 is a flow diagram of a microcomputer program used in the hygrometer system of FIG. 7; and

FIG. 9 is a graph showing the relationship between ambient temperature and water vapor saturation pressure.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following, a detailed description will be given of a preferred embodiment of the invention, together with the manufacturing process. FIG. 1 is an oblique view of this embodiment of the invention, at an intermediate stage in the manufacturing process. A substrate 20 is formed of a material such as a metal, e.g., stainless steel, or a single silicon crystal. An insulating layer 22 is first formed on substrate 20, composed of a film of silicon nitride (Si_3N_4), which is highly resistant to humidity. This film is deposited by plasma chemical vapor deposition (CVD) to a thickness of approximately 6000 angestroms.

Next, a thin film of P-type lead tellurium (PbTe) having a thickness of two microns is formed on insulating layer 22 by evaporative deposition. This layer is utilized to form a first Peltier metallic layer and a temperature measurement resistor. Photo-etching of this P-type lead tellurium film is performed to selectively etch the film to form patterns constituting a first Peltier metallic layer 24 a the temperature measurement resistor 32.

First Peltier metallic layer 24 is patterned as a plurality of strips which are arrayed at regular spacings, with each strip extending from the peripheral region of insulating layer 22 to the central region thereof. The temperature measurement resistor 32 is patterned to extend around the periphery of insulating layer 22, surrounding first Peltier metallic layer 24.

A further portion of the insulating layer 22 is then formed by plasma CVD of silicon nitride to a thickness of approximately 3000 angstroms, covering the patterns of first Peltier metallic layer 24. Photo-etching is then carried out to selectively etch the silicon nitride film to form contact apertures. These will be utilized to provide contact access between first Peltier metallic layer 24 and a second Peltier metallic layer 25 which is formed as described hereinafter. These contact apertures are formed at the end portions of the first Peltier metallic layer strips.

Next, a thin film of N-type lead tellurium having a thickness of approximately 2 microns is formed by evaporative deposition over the entire upper surface of the insulating layer 22, including the contact apertures. This layer of lead tellurium serves to form the second Peltier metallic layer 25.

Photo-etching is then performed to selectively etch this lead tellurium layer to pattern the second Peltier metallic layer 25, as shown in FIG. 1, i.e., as a plurality of strips which respectively contact the end portions of the first Peltier metallic layer strips through the contact apertures formed as described above. Specifically, each of the second Peltier metallic layer strips 25 contacts an adjacent one of the first Peltier metallic layer strips 24 at a centrally disposed end portion thereof, and contacts another one of the first Peltier metallic layer strips 24 at a peripheral end portion thereof.

However, one of the plurality of second Peltier metallic layer strips 25 only contacts an end portion of one first Peltier metallic layer strip 24. The other end of this second Peltier metallic layer strip 25 constitutes one electrode of the Peltier cooling means as described hereinafter. Similarly, one of the plurality of first Peltier metallic layer strips 24 only contacts an end portion of one of the second Peltier metallic layer strips 25 at an end portion of that first Peltier metallic layer strip. The other end of this first Peltier metallic layer strip 24 constitutes the other electrode of the Peltier cooling means.

Due to this patterning, the first Peltier metallic layer 24 and second Peltier metallic layer 25 are successively connected in an alternating manner. Electrically speaking, these form a single unit which constitutes the Peltier cooling means.

Of the junctions formed between first Peltier metallic layer 24 and second Peltier metallic layer 25, the junctions which are disposed in the central region of substrate 20 will be designated as a first group of junctions 26, while the junctions which are disposed at the periphery of substrate 20 will be designated as a second group of junctions 27. When electric current is passed through these junctions in a specific direction, heat will be absorbed by the first group of junctions 26, while heat will be generated by the second group of junctions 27. Thus, the first group of junctions 26 which are concentrated at the central region of the substrate will perform cooling of that region.

In order to protect the Peltier cooling means and the ambient temperature sensing means, another thin film of silicon nitride is deposited by CVD deposition to a thickness of approximately 6000 angstroms. This constitutes a further portion of the insulating layer 22. Photo-etching of this silicon nitride film is then performed to form contact apertures at the respective electrode portions of the Peltier cooling means and the ambient temperature sensing means.

To ensure improved ohmic contact, a thin metallic film of a material which is suitable for connecting leads, such as aluminum, is then formed to a thickness of approximately 1 micron over the entire surface of insulating layer 22 including the contact apertures, by evaporative deposition. Photo-etching of this layer is then performed to selectively pattern the layer to form contact pads 34*a*, 34*b* for the Peltier cooling means (shown in the oblique view of FIG. 2) and contact pads 36*a*, 36*b* of the ambient temperature sensing means, as well as contact pads for water droplet sensing means 33. As shown in FIG. 2, the water droplet sensing means 33