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# United States Patent [19]

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Kasai

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## [54] SENSOR HAVING A MICRO-BRIDGE HEATER

### FOREIGN PATENT DOCUMENTS

57-94641 12/1982 Japan .

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### [57] ABSTRACT

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A sensor including a micro-bridge heater which is located above a depression in the surface of a substrate. The heater includes a first insulating film on the substrate, a conductive film on the first insulating film, and a second insulating film on the conductive film. The first and second insulating films are made of the same material, preferably tantalum oxide (Ta<sub>2</sub>O<sub>5</sub>) and are the same thickness. A foundation film is not employed as an adhesive between the first insulating film and the conductive film due to the strong adherence between the first insulating film and the conductive film which is preferably made of platinum or a platinum alloy. Because the first and second insulating films are made of the same material and have the same thicknesses, the insulating films have similar rates of thermal expansion and the expansion or contraction of the insulating films offset each other, thus reducing the thermal stress imposed on the conductive film.

### [30] Foreign Application Priority Data

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[51] Int. Cl.<sup>6</sup> ..... H01L 23/58

[52] U.S. Cl. .... 257/252; 257/253; 257/414; 422/95; 422/97; 422/98; 338/34; 73/23.24

[58] Field of Search ..... 257/252, 253, 257/414; 422/97, 98, 95; 338/34; 73/23.24

### [56] References Cited

#### U.S. PATENT DOCUMENTS

4,343,768 8/1982 Kimura ..... 422/97  
4,791,465 12/1988 Sakai et al. .... 257/414  
4,967,589 11/1990 Yagawara et al. .... 73/23.25  
5,003,812 4/1991 Yagawara et al. .... 73/31.06

9 Claims, 3 Drawing Sheets

