FIG. 5—Cross-sectional view of non-limiting structural alternatives for banks on bi-layer of normal metal (N) and superconductor (S).

EXAMPLES

Example 1

A TES having the structure schematically shown in FIG. 2 was fabricated by sputtering Mo as the superconducting TES layer and sputtering Cu as the normal TES layer. The two films were deposited in one pumping cycle to maintain a clean metallic interface and patterned by wet etching. The normal banks were then fabricated by e-beam evaporation of Cu through a lift-off stencil. Prior to depositing the banks, the exposed portions of the device were sputter cleaned. The thickness of the normal banks was chosen such that the region of the bank in contact with the superconducting base layer has a transition temperature significantly lower than the bulk of the TES. The superconducting transition of this structure is shown in FIG. 1C. The transition was very narrow with no visible structure, as desired.

Example 2

A trilayer TES with normal metal banks structure, schematically shown in FIG. 3 can also be prepared. The use of a superconducting-normal-superconducting trilayer should increase the TES critical current, improving detector performance. In this example, the normal metal banks provide for normal boundary conditions, but do not fully passivate the TES edges due to the exposed superconducting/normal metal interface of the top layer. For a materials combination like Mo/Cu which exhibits low corrosion, this is likely to be acceptable. However, it may be desirable to put a thin layer of Cu on top and make a fully passivated quadlayer.

Example 3

FIG. 4 shows another variation using normal metal passivation. In order to make such a structure, it is necessary to deposit and pattern the two films of the bilayer separately, with the normal metal layer being deposited together with the banks. While we have made working bilayers by such a method, we find the bilayer properties are not optimally controlled by such a method. It is contemplated that suitable modifications can be made to optimize control for such bilayers.

The preceding examples can be repeated with similar success by substituting the generically or specifically described reactants and/or operating conditions of this invention for those used in the preceding examples.

From the foregoing description, one skilled in the art can easily ascertain the essential characteristics of this invention and, without departing from the spirit and scope thereof, can make various changes and modifications of the invention to adapt it to various usages and conditions.

Upon further study of the specification and appended claims, further objects and advantages of this invention will become apparent to those skilled in the art.

We claim:

1. A transition edge sensor comprising a structure of two or more metal layers on a substrate and electrical leads on outer sides of said structure, at least one of those layers being a normal metal layer and at least one of those layers being a superconducting metal layer, the at least one normal metal layer and superconducting metal layer overlaying each other, wherein at least two outer sides, other than the ones containing the electrical leads, of the at least one normal metal layer and the at least one superconducting metal layer and their corresponding outer interfaces are covered by a bank of normal metal.

2. The transition edge sensor of claim **1**, wherein the structure of the layers is square, rectangular or trapezoidal, the leads are provided on opposing outer sides and the banks are provided on both outer sides not containing the leads.

3. The transition edge sensor of claim **1**, wherein the banks result in normal-metal boundary conditions on the outer sides where they are provided.

4. The transition edge sensor of claim **1**, which has a superconducting metal layer on the substrate and a normal metal layer on the superconducting layer.

5. The transition edge sensor of claim **4**, wherein the banks are of the same normal metal as the normal metal layer.

6. The transition edge sensor of claim **5**, wherein the banks and the normal metal layer are integrally formed in a single deposition step.

7. The transition edge sensor of claim **5**, wherein the superconducting metal layer is elemental Mo; and, the normal metal layer is of copper, gold or silver.

8. The transition edge sensor of claim **4**, wherein the normal metal layer has a smaller surface area than the superconducting metal layer and is contained within the periphery of the superconducting metal layer.

9. The transition edge sensor of claim **1**, which has a superconducting metal layer on the substrate, a normal metal layer on the superconducting layer and a second superconducting layer on the normal metal layer.

10. The transition edge sensor of claim **1**, wherein at least one superconducting metal layer is of elemental Mo, Ti, Al, Zr, W, Ir, Ta or Hf; at least one normal metal layer is of gold, silver, copper, palladium, platinum, a gold/copper alloy or a palladium/gold alloy; and the banks are of gold, silver, copper, palladium, platinum, a gold/copper alloy or a palladium/gold alloy.

11. The transition edge sensor of claim **1**, wherein at least one superconducting metal layer is of elemental Mo or Ti; and, at least one normal metal layer is of copper, gold or silver.

12. The transition edge sensor of claim **1**, wherein at least one superconducting metal layer has a thickness of 0.05 to 10 μm; and, at least one normal metal layer has a thickness of 0.05 to 10 μm.

13. The transition edge sensor of claim **1**, wherein the superconducting transition temperature, T_c, of the sensor is from 50 to 500 mK.

14. The transition edge sensor of claim **1**, wherein the width of the transition edge of the sensor is less than 0.1 mK.

15. A device comprising a precision thermometer where the thermometer is comprised of a transition edge sensor according to claim **1**.

16. A particle or energy detector which comprises a transition edge sensor according to claim **1** and, in connection therewith, an absorber for absorbing the particle or energy, which absorber may be the transition edge sensor itself or some other component.

17. An x-ray microcalorimeter which comprises a transition edge sensor according to claim **1** and, in connection therewith, an absorber for absorbing x-rays, which absorber may be the transition edge sensor itself or some other component.

18. An x-ray microcalorimeter of claim **17**, wherein the microcalorimeter is a spectrometer.

19. An x-ray microcalorimeter of claim **17**, wherein the superconducting transition temperature, T_c, of the transition edge sensor is from 50 to 150 mK.