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VAPOR DEPOSITING INFRA-SENSITIVE ANTIMONY TRITELLURIDE

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This invention relates to infrared sensitive photoconductive material for the sensing layer of a television pickup tube.

Television pickup tubes, such as disclosed in U.S. Patent No. 3,144,575, issued to Babits on Aug. 11, 1964, are characterized by the presence of an infrared sensitive material of which barium titanate is illustrative for high temperature operation. Infrared sensitive target material is discussed further in the Patents Nos. 3,003,075; 2,959,481; 3,046,441; 3,136,909; 3,020,442; and 2,739,079.

The present invention is a new and improved process for causing the deposition on a substrate of a porous layer of antimony tritelluride (Sb_2Te_3), for use as an infrared sensing layer within a television pickup tube. The bulk material used for the deposition is the combination of stoichiometric weights of antimony and tellurium. The molecular weight of antimony is 121.76. The molecular weight of gaseous tellurium as Te_2 is 255.22. The molecular weight of Sb_2Te_3 is 626.35.

Experimentally stoichiometric weights of antimony and of tellurium were placed in a quartz ampule and were reacted together for two hours. An antimony tritelluride crystal was then grown vertically from the resulting material at a rate of 1.5 inches per hour.

The antimony tritelluride crystal was placed in a boat made of tantalum. The antimony tritelluride crystal in the tantalum boat was then subjected to vacuum evaporation in a closed chamber. The chamber pressure was held at from 1 to 2 millimeters of mercury. The chamber atmosphere was air. The chamber was maintained at 660° C. temperature and the time for evaporation was three minutes.

An illustrative porous layer prepared by this method was of about 15 microns thickness. The porous layer so prepared and installed in a pickup tube passively detected a heated source at 170° C. above ambient as well as at higher temperatures.

The performance sensitivity of the porous layer mounted in a pickup tube was increased to 120° C. by a further treatment. The further treatment consisted of a subsequent vacuum bake of the porous layer at 100° C. for one-half hour in the same chamber with its air atmosphere and vacuum pressure of from 1 to 2 millimeters of mercury.

The performance sensitivity of the resultant porous layer exhibited a fairly good speed of response.

The study of antimony tritelluride layers with a light microscope showed the particle clumping or agglomeration size within the porous layer to average about 8 microns in diameter.

Both porous and solid layer combinations that are prepared under vacuums of 0.1 millimeter of mercury and below are included within the scope of this invention.

The porous layers of antimony tritelluride that are made by the process described herein exhibit adequate sensitivity for frame storage operation as a pickup tube sensing layer at the temperature of liquid nitrogen, which is between −209.86 and −195.8° C.

In addition, the layers prepared by the process that is described herein exhibit imaging sensitivity in the pickup tube application at wave lengths well in excess of two microns. The band gap of antimony tritelluride is reported in the literature to be 0.3 electronvolt (ev.). It is to be expected therefore that long wave length responses of from 3 to 4 microns, are obtainable from the use of the layers that are produced from the practice of the present invention.

I claim:

1. The process of reacting together stoichiometric weights of antimony and of tellurium for two hours in making antimony tritelluride, growing a crystal vertically from the reaction product of stoichiometric weights of antimony and of tellurium, depositing upon a substrate a porous layer of antimony tritelluride by placing the grown crystal of antimony tritelluride in a tantalum boat within a chamber having an air atmosphere and a pressure of from 1 to 2 millimeters of mercury and maintained at about 660° C., evaporating for about three minutes the antimony tritelluride for accomplishing its deposition as a porous layer on the substrate, and subsequently baking the porous layer at 100° C. for one-half hour in an air atmosphere at a pressure of about 1 to 2 millimeters of mercury.

2. The process of depositing a coating of antimony tritelluride on a substrate by positioning a crystal of antimony tritelluride in a tantalum boat within a chamber with an air atmosphere at a pressure of from 1 to 2 millimeters of mercury and a temperature of about 660° C. and containing the substrate, causing the antimony tritelluride to deposit on the substrate, and baking the deposition on the substrate within the evacuated chamber at 100° C. for one-half hour.

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