

ABSTRACT

Non-Linear Resistance Element, Method of Its Manufacture
, and Liquid Crystal

A nonlinear resistance element of this invention is comprising a first conductive layer, an insulating layer, and a second conductive layer stacked in sequence on a substrate, wherein: the first conductive layer is a metal film whose main component is a metal such as tantalum to which is added a chemical element having a valence 1 or 2 greater than that of the metal, preferably tungsten in the concentration of 0.2% to 6 atom%, more preferably in a proportion of 0.3% to 6 atom%, and the insulating layer is an anodized layer of the first conductive layer.

With this nonlinear resistance element, if the current density in the element is J_2 when a bias voltage of 10 V is applied after a current is injected for 10 seconds at a current density of 1 A/cm², and the current density is J_1 when a bias voltage of 10 V is applied after no current is injected, the following Equation 2 is approximately satisfied, where the constants B and n in Equation 2 preferably satisfy the relationships $|B| \leq 0.2$ and $n \leq 0$:

Equation 2: $\log (J_2/J_1) = B \times t^{1/n}$

where: t is the elapsed time (in seconds) since the bias voltage was applied.

This nonlinear resistance element is particularly suitable for use as a switching element for an active matrix type of liquid crystal display device.

Fig.11.