Method for producing electric trigger elements for pyrotechnic articles

The invention relates to a method for producing electric trigger elements for pyrotechnic articles such as fuses or igniters.

Electric trigger elements serve to initiate a primary explosive as the first member of a fuse or igniter chain. For this purpose, the heat generated which is emitted by a resistor through which a current flows is used. The primary explosive is in direct contact with the electric resistor and is initiated by reaching its deflagration temperature. The electric resistor can be configured, for example, in the form of a wire.

The production method relates to a special form of igniter element wherein the electric resistor is formed by a thin metal film on an insulating substrate surface. Trigger elements of this type have been in general use for many years. The resistor layer made of a metal with a high specific resistance is applied by a physical vapor deposition (PVD) process onto the substrate (e.g. ceramic or glass) and, if required, is reinforced remote from the well-defined resistor area by a further layer of a material with a high electrical conductivity. The geometry of the resistor area is adapted to the requirements of the use, in particular, in relation to the resistance value and the initiation characteristic (e.g. the required current strength). In established production methods, the form of the resistor area (the thickness of which is given by the layer thickness of the metal film) is generated by laser material machining on each individual component.

Due to the influence of the high laser power during the material machining, undesirable material changes can occur at the edges of the laser cut. These material changes (of both geometrical and substantial types) have negative effects on the initiation characteristics of the resistor layer. Additionally, the individual machining of each trigger element is very time-consuming.

Summary

In one aspect, the present invention provides a method for producing electric trigger elements for pyrotechnic articles, characterized in that, in a first stage,

a) a lacquer is applied by photolithography to an electrically non-conductive substrate,

b) a conductive material having a specific resistance of 0.1 Ω*mm to 5.0 Ω*mm is applied to the lacquer and substrate by means of a PVD process in a layer thickness of 0.02 µm to

8.0 µm, and

c) the lacquer is removed from the substrate

and possibly, in a second stage

d) a photolithographic process is again carried out in which a precisely defined region of the resistor strip is covered with photoresist,

e) the entire substrate surface is covered with a layer of a metal having a specific resistance of 0.01 Ω*mm to 0.1 Ω*mm in a thickness of 0.1 µm to 20 µm, wherein the application of the metal is configured such that in regions which have a bare substrate from the first photolithographic process, no metal adheres, and

f) the lacquer from the second photolithographic process is again removed.

In another aspect, the present invention provides use of the method disclosed herein for producing pyrotechnic trigger elements.

Detailed Description

It is an object of the invention to provide a new method for producing initial elements based on PVD layers that enables a clean configuration of the edges of the resistor layers. It is also desirable to reduce the manufacturing costs.

According to the invention, the object is achieved in that firstly a lacquer is applied by photolithography onto the substrate. This prevents a coating of the substrate in a large region, but leaves free a region of the substrate surface of precisely defined width.