A method for making a self-controlled heater comprises using a polymeric semiconductor based on lampblack, cut into plate (2) with the intended configuration for the heater and then printing on it, through silkscreening, of an electric conductive track (3) with silver ink. The heater includes a polymeric semiconductive substrate based on lampblack (1) having an electric conductive track printed with silver ink (3).
ABSTRACT

A method for making a self-controlled heater comprises using a polymeric semiconductor based on lampblack, cut into plate (2) with the intended configuration for the heater and then printing on it, through silkscreening, of an electric conductive track (3) with silver ink. The heater includes a polymeric semiconductive substrate based on lampblack (1) having an electric conductive track printed with silver ink (3).
IMPROVEMENT IN A METHOD OF MAKING A
SELF-CONTROLLED HEATER AND AN IMPROVED
SELF-CONTROLLED HEATER

The present invention concerns a method for making a
self-controlled heater and the obtained heater, belonging to
the field of heaters and applicable in all those situations
in which heating is used to fight against humidity and in
which it is necessary that heating is controlled based on the
latter.

The present applicant has developed a polymeric
semiconductor compound based on lampblack and comprising
essentially (in % by weight) low density polyethylene (PEBD)
60%; acetate ethylene copolymer 8.5%; conductive lampblack
with selected porous structure 20%; spreading agent consisting
in Calcium Stearate 4.0%; anti-oxidant 3.0%, and Calcium
Titanate coupling agent 0.5%, applicable for the manufacture
of an improved polymeric semiconductor based on lampblack,
which is obtained through extrusion and calendering and is for
use in electrical materials and/or devices.

The object of the present invention is to apply the
improved polymeric semiconductor based on lampblack, above
mentioned, in the building of self-controlled heaters used
mainly for the control of humidity.
In drawings illustrating preferred embodiments of the invention:

Figure 1 shows a scheme of the method;

Figure 2 shows a scheme of the heater;

Figures 3 and 4 show the characteristic curves of the self-controlled heater of the invention.

Pursuant to what is shown in Figure 1 above mentioned, the improvement in the method for making a self-controlled heater, subject of the present invention, includes first the use of a polymeric semiconductor compound based on lampblack, (CSPBNF) comprising (by weight) low density polyethylene (PEBD) 60%; acetate ethylene copolymer 8.5%; conductive lampblack with selected porous structure 20%; spreading agent comprising calcium stearate 4.0%; antioxidant 3.0%; and calcium titanate coupling agent 0.5%, with the incorporation of the conductive component in the polymeric matrix made by spreading mixture in intermittent "Bambury" type mixers, and under process conditions selected to obtain high rates of lampblack shearing.

The method for making the self-controlled heater, itself, may make use of both original and recycled raw material and includes essentially an "A" phase in which a polymeric semiconductor band or strip 1 based on lampblack is moulded and which consists of the following stages:

(a) Drying for 4 hours at a temperature of +70°C in a forced ventilation oven, to remove all moisture; and
(b) Forming the product, which includes:

I) extruding in an extruder having an entrance funnel maintained at about 200°C, a second extrusion zone at 200°C; and a third extrusion zone maintained at 200°C. A thread rotation of 1,500 rpm is used for recycled material and 1,200 rpm for virgin material. The pooler is set at 1:150 rpm for recycled material and 2:150 for virgin material; and

II) calendering with no water circulation and no pressure and with a distance from calender flap of about 10 mm, flap opening: 0.55+/-0.05 mm to form a polymeric semiconductor plate.

Then comes a "B" phase of forming polymeric semiconductive plates 2 based on lampblack, from the polymeric semiconductive band 1 as obtained above, consisting of cutting the band 1 with cutting blades.

After the "B" phase, a "C" phase is performed including printing an electric conductive track 3 on the plate 2. The steps in the "C" phase include:

(a) Cleaning the plate 2 with alcohol;

(b) Flaming or slightly burning the surface 4 of plate 2 which receives the electrical conductor track 3;

(c) Silk screen printing on a printing table with fixation of the plate 2 under vacuum and contour gauge, with the same contours of the heater model and with the same thickness of plate 2;
(d) Prior drying at room temperature during a predetermined proper time;
(e) Drying in an oven at +70°C during 20 to 30 minutes; and
(f) Fixing terminals 5 on the plate for the tracks printed during the silk-screen printing.

The ink used is of the silver type.

The obtained self-controlled heater is schematically illustrated in the attached Figure 2 and includes essentially a semiconductor polymer substrate based on lampblack 1, comprising (in % by weight): 60% low density polyethylene (PEBD); acetate ethylene copolymer 8.5%; conductive lampblack with selected porous structure 20%; spreading agent consisting of calcium stearate 4.0%; anti-oxidant 3.0%, and calcium titanate coupling agent 0.5%, with lampblack aggregations having a high degree of shearing and low degree of orientation. This plate has printed on it a silver ink conductor track 3 with negative poles 6 and positive poles 7, linked to the suitable terminals 5 and also having interpenetrating and adjacent parts 8 and 9 which are spaced at intervals 10 from each other. These and the above-mentioned interpenetrating and adjacent parts 8 and 9 are conveniently dimensioned to provide the proper heat transfer to the area and/or space where the moisture level is to be controlled.
The heater with the above features may be made in various dimensions, shapes and capacities for heat transfer, as intended for the individual application.

An example of a preferred embodiment of this heater, which is useful for defrosting or defogging a mirror, particularly a rearview mirror of a motor vehicle, has the following specifications:

<table>
<thead>
<tr>
<th>CHART WITH SPECIFICATIONS OF THE SELF-CONTROLLED HEATER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Power:</td>
</tr>
<tr>
<td>Maximum Power:</td>
</tr>
<tr>
<td>Operative:</td>
</tr>
<tr>
<td>Tension:</td>
</tr>
<tr>
<td>Area:</td>
</tr>
<tr>
<td>Temperatures:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Durability:</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Salt-Spray:</td>
</tr>
<tr>
<td>Defrozing:</td>
</tr>
</tbody>
</table>

FIGS. 4 and 5 show the properties of the preferred heater in use to clear a rearview mirror of a vehicle. FIG. 3 shows
the dependence of the current on time when a voltage of 12 volts is applied to the terminals of the heater. FIG. 4 shows the behavior of the heater in defrosting a mirror to which it is attached. The y-axis shows the % defrost and the x-axis shows the time.
WE CLAIM:

1. A method of making a self-controlled heater based on lampblack comprising the steps of:

a) making a polymeric semiconductor band composed of a polymeric semiconductor compound based on lampblack and consisting essentially of 60% by weight low density polyethylene, 8.5% by weight ethylene vinyl acetate copolymer, 20% by weight conductive lampblack having a porous structure; 4.0% by weight of a spreading agent consisting of calcium stearate; 3.0% by weight of an antioxidant; and 0.5% by weight of a coupling agent consisting of calcium titanate, the polymeric semiconductor compound being made by incorporating a conductive component including the lampblack in a polymeric matrix by spreading a mixture made from the low density polyethylene, the ethylene vinyl acetate copolymer, the lampblack, the spreading agent, the antioxidant and the calcium titanate in an intermittent "bambury" type mixer under process conditions selected to obtain a high level of lampblack shearing;

b) molding the polymeric semiconductor band in an "A" phase including the steps of drying for four hours at a temperature of 70°C in a forced ventilation oven; and forming consisting essentially of

I) extruding in an extruder having an entrance funnel maintained at about 200°C, a second extrusion zone at 200°C; and a third extrusion zone maintained at 200°C, wherein a
thread rotation of 1,500 rpm is used for recycled material and 1,200 rpm for virgin material and the pooler is set at 1:150 rpm for recycled material and 2:150 for virgin material; and (II) calendering with no water circulation and no pressure and with a distance from calender flap of about 10mm, flap opening 0.55+-0.05 mm so as to form a polymeric semiconductor plate.

2. The method of claim 1, further comprising a "B" phase comprising cutting the polymeric semiconductor plate, produced by said "A" phase, with a cutting knife to form a shape or body for the heater.

3. The method of claim 1 or 2, further comprising a "C" phase for printing of an electric conductive track over the polymeric semiconductor plate, said "C" phase comprising:
   
   (a) cleaning the polymeric semiconductor plate with alcohol;

   (b) flaming or slightly burning a surface of the polymeric semiconductor plate for receiving the electric conductive track;

   (c) silkscreen printing on a printing table with fixing of the polymeric semiconductor plate under vacuum and contour gauge, with the same contours of the heater model and with the same thickness of the polymeric semiconductor plate;

   (d) prior drying at room temperature during a predetermined proper time;
(e) drying in an oven at +70°C for 20 to 30 minutes; and
(f) fixing of terminals on the polymeric semiconductor plate for the electrical conductor track.

4. The method of claim 3, wherein ink used is of a silver type.

5. Self-controlled heater of a rearview mirror of a vehicle comprising: a semiconductor polymer substrate consisting essentially of 60% by weight low density polyethylene, 8.5% by weight ethylene vinyl acetate copolymer, 20% by weight conductive lampblack having a porous structure; 4.0% by weight of a spreading agent consisting of calcium stearate; 3.0% by weight of an antioxidant; and 0.5% by weight of a coupling agent consisting of calcium titanate, with a high degree of shearing and a low degree of orientation for lampblack aggregations, a silver ink conductor track (3) printed on said substrate, said conductor track including negative and positive poles (8,9) having interpenetrating adjacent branches (8,9) spaced at intervals (10) from each other so as to provide a sufficient amount of heat to the rearview mirror for defogging and defrosting the rearview mirror; and two terminals (5) on said substrate, one of said two terminals (5)
being connected to said negative pole and another of said two terminals (5) being connected to said positive pole.

CASSAN MACLEAN
80 Aberdeen Street, Suite 401
Ottawa, Ontario
K1S 5R5

Agents for the Applicant
**FIG. 3**

*fig. 3* 2/2

Heater AC @ 12V (193 cm²)

**FIG. 4**

teste de gelo, heater AC

Agents for the Applicant