CLAIMS

1. Article suitable to act as a thermal switch device, the article having a surface resistance of more than 10^5 ohms as determined according to ASTM D257-07, and being formed from a polymer composition, said polymer composition comprising

   - from 50 to 99.9 wt% relative to the total weight of the polymer composition, of a polymer being selected from an amorphous polymer having a glass transition temperature Tg, a semi-crystalline polymer having a melting temperature Tm or a mixture thereof, and
   - from 0.1 to 50 wt% relative to the total weight of the polymer composition, of a conductive material;

   wherein the surface resistance of the article is divided by at least 10, preferably by at least 100, when said article is submitted for a determined period of time of less than 5 minutes to a temperature of switch

   i) ranging from Tg + 10 °C to Tg + 250 °C if the polymer composition comprises an amorphous polymer, or
   ii) ranging from Tm – 80 °C to Tm + 250 °C if the polymer composition comprises a semi-crystalline polymer.

2. Article according to claim 1, wherein the conductive material of the polymer composition is selected from the group comprising carbon nanotubes, carbon nanofibers, carbon black, metal fibers, metal powders and blends thereof, preferably from the group comprising carbon nanotubes, carbon nanofibers, carbon black, and blends thereof, more preferably the conductive material is carbon nanotubes.

3. Article according to claim 1 or 2, wherein the polymer composition comprises an amorphous polymer, preferably said amorphous polymer is selected from polystyrene (PS), atactic polypropylene (aPP), acrylonitrile-butadiene-styrene (ABS), polycarbonate (PC), styrene acrylonitrile (SAN), poly(methyl methacrylate) (PMMA), poly(vinyl chloride) (PVC), polybutadiene (PBu), polybutylene terephthalate (PBt), poly(p-phenylene oxide) (PPO), polysulfone (PSU), polyethersulfone (PES), polyethylenimine (PEI), polyphenylsulfone

(PPSU), acrylonitrile styrene acrylate (ASA) or any combination thereof, preferably the amorphous polymer is polystyrene.

4. Article according to any claims 1 to 3, wherein the polymer composition comprises an semi-crystalline polymer, preferably said semi-crystalline polymer is selected from polyamide, homo- and co- polymer of ethylene (PE), homo- and co- polymer of propylene (PP), impact copolymer of propylene (IPP), Polylactide (PLA), polyether ether ketone (PEEK), polyoxymethylene (POM), syndiotactic polystyrene (sPS), polyphenylene sulfide (PPS), liquid crystalline polymers (LCP), homo- and co- polymer of butane, homo- and co- polymer of hexene, ethylene vinyl acetate (EVA), polyurethane or any combination thereof; preferably the semi-crystalline polymer is selected from homo- and co- polymer of ethylene (PE), homo- and co- polymer of propylene (PP), impact copolymer of propylene (IPP), Polylactide (PLA), or any combination thereof.

5. Article according to any claims 1 to 4, wherein the surface resistance of the article is divided by at least 10, preferably by at least 100, when said article is submitted for a determined period of time of less than 5 minutes to a temperature of switch ranging from Tg + 75 °C to Tg + 250 °C, preferably from Tg + 100 °C to Tg + 250 °C if the polymer composition comprises an amorphous polymer.

6. Article according to claim 5 wherein the surface resistance of the article is divided by at least 10, preferably by at least 100, when said article is submitted for less than 2 minutes to the temperature of switch.

7. Article according to any claims 1 to 6, wherein the polymer composition comprises at least 0.5 wt%, more preferably at least 0.8 wt%, even more preferably at least 1.0 wt%, most preferably at least 1.2 wt% relative to the total weight of the polymer composition, of the conductive material.

8. Article according to any of the previous claims 1 to 7 having a thermal conductivity higher than 0.4 W/(m*K).

9. Article according to any claim 1 to 8, wherein the article is a film, a sheet, a formed sheet, a pipe or an injected article.

10. Process to produce an article suitable to act as a thermal switch device according to any claim 1 to 9, comprising the step of:
    a) providing a polymer composition having a surface resistance of less than 10^4 ohms, said polymer composition comprising:
    - from 50 to 99.9 wt% relative to the total weight of the polymer composition, of a polymer being selected from an amorphous polymer having a glass transition temperature Tg, a semi-crystalline polymer having a melting temperature Tm or a mixture thereof, and
    - from 0.1 to 50 wt% relative to the total weight of the polymer composition, of a conductive material;
    b) forming or pre-forming an article; and
    c) cooling the article by contact with a cooling device system or medium using a temperature of at least Tg – 20 °C if the polymer composition comprises an amorphous polymer or at least Tm – 20°C if the polymer composition comprises a semi-crystalline polymer.

11. Process according to claim 10, wherein the step b) of forming or pre-forming the article is made by extrusion or injection.

12. Process according to any claims 10 to 11, wherein the step c) comprises cooling the article by a cooling device system using a temperature ranging from Tg – 20 °C to Tg – 150 °C if the polymer composition comprises an amorphous polymer or ranging from Tm – 20 °C to Tm – 150 °C if the polymer composition comprises a semi-crystalline polymer.

13. Process according to any claims 10 to 12, the process comprising a step b) of pre-forming the article resulting in a pre-formed article wherein the process further comprises after step c), a step d) of forming the article from the preformed article at a temperature less than Tg when the polymer composition comprises an amorphous polymer or less than Tm when the polymer composition comprises a semi-crystalline polymer.

14. Use of a polymer composition having a surface resistance of less than 10^4 ohms to produce the article of claims 1 to 9, in a process according to claims 10 to 13.