CLAIMS

1. A patterned transparent conductor comprising:

a non-conductive substrate,

a first conductive line on the non-conductive substrate, the first conductive line comprising a first network of conductive nanostructures and having a first lengthwise direction;

a second conductive line on the non-conductive substrate, the second conductive line comprising a second network of conductive nanostructures and having a second lengthwise direction; and

an insulating region electrically isolating the first conductive line from the second conductive line, the insulating region having a first non-conductive boundary laterally abutting the first conductive line along the first lengthwise direction and a second non-conductive boundary laterally abutting the second conductive line along the second lengthwise direction,

wherein the insulating region comprises a plurality of conductive material islands disposed on the non-conductive substrate and electrically isolated from each other by non-conductive gaps, each conductive material island comprising a respective plurality of conductive nanostructures~~.~~, and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have any conductive network of metal nanostructures.

2. The patterned transparent conductor of claim 1 wherein the first lengthwise direction and the second lengthwise direction are substantially parallel to each other.

3. The patterned transparent conductor of claim 1 wherein the first non-conductive boundary is straight.

4. The patterned transparent conductor of claim 1 wherein the second non-conductive boundary is straight.

5. The patterned transparent conductor of claim 1 wherein the first non-conductive boundary is irregular.

6. The patterned transparent conductor of claim 5 wherein the second non-conductive boundary is straight.

7. The patterned transparent conductor of claim 1 wherein the conductive material islands are parallelogram-shaped.

8. The patterned transparent conductor of claim 1 wherein the conductive material islands are irregular-shaped.

9. The patterned transparent conductor of claim 1 wherein the conductive material islands have surface areas that are within the range of 0.1-10 mm^2 or 0.5-2 mm^2.

10. The patterned transparent conductor of claim 1 wherein no metal nanostructures are present in the non-conductive gaps, the first and second non-conductive boundaries.

11. The patterned transparent conductor of claim 1 wherein the non-conductive gaps, the first and second non-conductive boundaries have metal nanostructures with structural defects that render them incapable of forming a conductive network.

12. A process of fabricating a transparent conductor with a low-visibility pattern, the process comprising:

directly printing a coating composition on a non-conductive substrate according to a pattern, the coating composition having a plurality of metal nanostructures and a volatile liquid carrier; and

removing the volatile liquid carrier,

wherein, the pattern defines a first conductive line having a first lengthwise direction on the non-conductive substrate; a second conductive line having a second lengthwise direction on the non-conductive substrate, and an insulating region electrically isolating the first conductive line from the second conductive line, the insulating region having a first non-conductive boundary laterally abutting the first conductive line along the first lengthwise direction and a second non-conductive boundary laterally abutting the second conductive line along the second lengthwise direction, wherein, the insulating region comprises a plurality of conductive material islands disposed on the non-conductive substrate and electrically isolated from each other by non-conductive gaps, each conductive material island comprising a respective plurality of conductive nanostructures, and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have any metal nanostructures.

13. The process of claim 12 wherein and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have any metal nanostructures.

14. A process of fabricating a transparent conductor with a low-visibility pattern, the process comprising:

coating a coating composition on a non-conductive substrate, the coating composition having a plurality of metal nanostructures and a volatile liquid carrier;

removing the volatile liquid carrier to provide a conductive network of metal nanostructures; and

etching the conductive network according to a pattern, wherein, the pattern defines a first conductive line having a first lengthwise direction on the non-conductive substrate; a second conductive line having a second lengthwise direction on the non-conductive substrate, and an insulating region electrically isolating the first conductive line from the second conductive line, the insulating region having a first non-conductive boundary laterally abutting

the first conductive line along the first lengthwise direction and a second non-conductive boundary laterally abutting the second conductive line along the second lengthwise direction, wherein, the insulating region comprises a plurality of conductive material islands disposed on the non-conductive substrate and electrically isolated from each other by non-conductive gaps, each conductive material island comprising a respective plurality of conductive nanostructures, and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have a conductive network of the metal nanostructures.

15. The process of claim 14 wherein the etching completely removes all of the metal nanostructures in the non-conductive gaps, the first and second non-conductive boundaries.

16. The process of claim 14 wherein the etching partially etches the metal nanostructures in the non-conductive gaps, the first and second non-conductive boundaries to cause structural defects.

CLAIMS

1. A patterned transparent conductor comprising:

a non-conductive substrate,

a first conductive line on the non-conductive substrate, the first conductive line comprising a first network of conductive nanostructures and having a first lengthwise direction;

a second conductive line on the non-conductive substrate, the second conductive line comprising a second network of conductive nanostructures and having a second lengthwise direction; and

an insulating region electrically isolating the first conductive line from the second conductive line, the insulating region having a first non-conductive boundary laterally abutting the first conductive line along the first lengthwise direction and a second non-conductive boundary laterally abutting the second conductive line along the second lengthwise direction,

wherein the insulating region comprises a plurality of conductive material islands disposed on the non-conductive substrate and electrically isolated from each other by non-conductive gaps, each conductive material island comprising a respective plurality of conductive nanostructures, and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have any conductive network of metal nanostructures.

2. The patterned transparent conductor of claim 1 wherein the first lengthwise direction and the second lengthwise direction are substantially parallel to each other.

3. The patterned transparent conductor of claim 1 wherein the first non-conductive boundary is straight.

4. The patterned transparent conductor of claim 1 wherein the second non-conductive boundary is straight.

5. The patterned transparent conductor of claim 1 wherein the first non-conductive boundary is irregular.

6. The patterned transparent conductor of claim 5 wherein the second non-conductive boundary is straight.

7. The patterned transparent conductor of claim 1 wherein the conductive material islands are parallelogram-shaped.

8. The patterned transparent conductor of claim 1 wherein the conductive material islands are irregular-shaped.

9. The patterned transparent conductor of claim 1 wherein the conductive material islands have surface areas that are within the range of 0.1-10 mm^2 or 0.5-2 mm^2.

10. The patterned transparent conductor of claim 1 wherein no metal nanostructures are present in the non-conductive gaps, the first and second non-conductive boundaries.

11. The patterned transparent conductor of claim 1 wherein the non-conductive gaps, the first and second non-conductive boundaries have metal nanostructures with structural defects that render them incapable of forming a conductive network.

12. A process of fabricating a transparent conductor with a low-visibility pattern, the process comprising:

directly printing a coating composition on a non-conductive substrate according to a pattern, the coating composition having a plurality of metal nanostructures and a volatile liquid carrier; and

removing the volatile liquid carrier,

wherein, the pattern defines a first conductive line having a first lengthwise direction on the non-conductive substrate; a second conductive line having a second lengthwise direction on the non-conductive substrate, and an insulating region electrically isolating the first conductive line from the second conductive line, the insulating region having a first non-conductive boundary laterally abutting the first conductive line along the first lengthwise direction and a second non-conductive boundary laterally abutting the second conductive line along the second lengthwise direction, wherein, the insulating region comprises a plurality of conductive material islands disposed on the non-conductive substrate and electrically isolated from each other by non-conductive gaps, each conductive material island comprising a respective plurality of conductive nanostructures, and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have any metal nanostructures.

13. The process of claim 12 wherein and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have any metal nanostructures.

14. A process of fabricating a transparent conductor with a low-visibility pattern, the process comprising:

coating a coating composition on a non-conductive substrate, the coating composition having a plurality of metal nanostructures and a volatile liquid carrier;

removing the volatile liquid carrier to provide a conductive network of metal nanostructures; and

etching the conductive network according to a pattern, wherein, the pattern defines a first conductive line having a first lengthwise direction on the non-conductive substrate; a second conductive line having a second lengthwise direction on the non-conductive substrate, and an insulating region electrically isolating the first conductive line from the second conductive line, the insulating region having a first non-conductive boundary laterally abutting

the first conductive line along the first lengthwise direction and a second non-conductive boundary laterally abutting the second conductive line along the second lengthwise direction, wherein, the insulating region comprises a plurality of conductive material islands disposed on the non-conductive substrate and electrically isolated from each other by non-conductive gaps, each conductive material island comprising a respective plurality of conductive nanostructures, and wherein the non-conductive gaps, the first and second non-conductive boundaries do not have a conductive network of the metal nanostructures.

15. The process of claim 14 wherein the etching completely removes all of the metal nanostructures in the non-conductive gaps, the first and second non-conductive boundaries.

16. The process of claim 14 wherein the etching partially etches the metal nanostructures in the non-conductive gaps, the first and second non-conductive boundaries to cause structural defects.