encapsulant materials, thereby increasing inkjet pen reliability. This roughening may be accomplished by a number of approaches such as the following: embossing the coverfilm with a textured metal layer (removed by etching), microreplication, or chemical roughening of the coverfilm.

One embodiment of the invention provides an article comprising a flexible circuit having a substrate layer, a patterned conductive circuit on the substrate layer, and a coverlayer on the conductive circuit comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer is textured, wherein the textured surface of the coverfilm is adhered to an inkjet printer encapsulant material.

Another embodiment of the invention provides a method comprising: providing a flexible circuit having a substrate layer and a patterned conductive circuit on the substrate layer, and applying a coverlayer onto the conductive circuit, the coverlayer comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer is textured and applying an inkjet printer encapsulant material onto the textured surface of the coverfilm.

Another embodiment of the invention provides an article comprising a flexible circuit having a substrate layer, a patterned conductive circuit on the substrate layer, and a coverlayer on the conductive circuit comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer comprises a thermoplastic polyimide material.

The above summary of the present invention is not intended to describe each disclosed embodiment or every implementation of the present invention. The Figures and detailed description that follow below more particularly exemplify illustrative embodiments.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 depicts an encapsulated connection between an inkjet die and a flexible circuit.

Fig. 2 depicts the structure of UPISEL-N material.

Fig. 3 is a digital image of an embodiment of a thermoplastic polyimide coverfilm surface of the present invention after a laminated roughened copper foil has been etched away.

Fig. 4 depicts an exemplary microreplication process for texturing the surface(s) of a coverfilm of an embodiment the present invention.

WHAT IS CLAIMED IS:

1. An article comprising:
   a flexible circuit having a substrate layer,
   a patterned conductive circuit on the substrate layer, and
   a coverlayer on the conductive circuit comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer is textured.

2. The article of claim 1 wherein the textured surface of the coverfilm has a random pattern.

3. The article of claim 1 wherein the textured surface of the coverfilm has a uniform pattern.

4. The article of claim 1 wherein the textured surface of the coverfilm has an average peak to valley distance of about 1 to about 3 micrometers.

5. The article of claim 1 wherein the textured surface of the coverfilm is adhered to an inkjet printer encapsulant material.

6. The article of claim 5 wherein the coverfilm and encapsulant material form an interpenetrating network at their interface.

7. The article of claim 1 wherein the coverfilm comprises a thermoset polyimide core clad on each side with a thin thermoplastic polyimide layer.

8. A method comprising:
   providing a flexible circuit having a substrate layer and a patterned conductive circuit on the substrate layer, and
   applying a coverlayer onto the conductive circuit, the coverlayer comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer is textured.

9. The method of claim 8 wherein the coverfilm surface is textured by heat laminating a roughened copper foil to the coverfilm, followed by etching away the copper foil.

10. The method of claim 8 wherein the coverfilm surface is textured by microreplication.

11. The method of claim 8 wherein the coverfilm surface is textured by embossing.

12. The method of claim 8 wherein the coverfilm surface is textured by chemical etching.

13. The method of claim 8 further comprising applying an inkjet printer encapsulant material onto the textured surface of the coverfilm.

14. An article comprising:

a flexible circuit having a substrate layer,

a patterned conductive circuit on the substrate layer, and

a coverlayer on the conductive circuit comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer comprises a thermoplastic polyimide material.

15. The article of claim 14 wherein the coverfilm comprises a thermoset polyimide core clad on each side with a thermoplastic polyimide layer.

16. The article of claim 14 wherein the adhesive comprises polyamide resin.

17. The article of claim 14 wherein the adhesive comprises polyamide resin, epoxy resin, and novolak phenolic resin.

18. The article of claim 14 wherein the thermoplastic polyimide material of the coverfilm is adhered to an inkjet printer encapsulant material.

19. The article of claim 14 wherein the thermoplastic polyimide material and encapsulant material form an interpenetrating network at their interface.

CLAIMS

1. An article comprising:

   a flexible circuit having a substrate layer,

   a patterned conductive circuit on the substrate layer, and

   a coverlayer on the conductive circuit comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer is textured,

   wherein the textured surface of the coverfilm is adhered to an inkjet printer encapsulant material.

2. The article of claim 1 wherein the textured surface of the coverfilm has a random pattern.

3. The article of claim 1 wherein the textured surface of the coverfilm has a uniform pattern.

4. The article of claim 1 wherein the textured surface of the coverfilm has an average peak to valley distance of about 1 to about 3 micrometers.

5. The article of claim 1 wherein the coverfilm and encapsulant material form an interpenetrating network at their interface.

6. The article of claim 1 wherein the coverfilm comprises a thermoset polyimide core clad on each side with a thin thermoplastic polyimide layer.

7. A method comprising:

   providing a flexible circuit having a substrate layer and a patterned conductive circuit on the substrate layer, and

   applying a coverlayer onto the conductive circuit, the coverlayer comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer is textured, and

   applying an inkjet printer encapsulant material onto the textured surface of the coverfilm.

8. The method of claim 7 wherein the coverfilm surface is textured by heat laminating a roughened copper foil to the coverfilm, followed by etching away the copper foil.

9. The method of claim 7 wherein the coverfilm surface is textured by microreplication.

10. The method of claim 7 wherein the coverfilm surface is textured by embossing.

11. The method of claim 7 wherein the coverfilm surface is textured by chemical etching.

12. An article comprising:

a flexible circuit having a substrate layer,

a patterned conductive circuit on the substrate layer, and

a coverlayer on the conductive circuit comprising a coverfilm adhered to the conductive circuit with an adhesive layer wherein the surface of the coverfilm opposite the adhesive layer comprises a thermoplastic polyimide material.

13. The article of claim 12 wherein the coverfilm comprises a thermoset polyimide core clad on each side with a thermoplastic polyimide layer.

14. The article of claim 12 wherein the adhesive comprises polyamide resin.

15. The article of claim 12 wherein the adhesive comprises polyamide resin, epoxy resin, and novolak phenolic resin.

16. The article of claim 12 wherein the thermoplastic polyimide material of the coverfilm is adhered to an inkjet printer encapsulant material.

17. The article of claim 12 wherein the thermoplastic polyimide material and encapsulant material form an interpenetrating network at their interface.