Silver nanowire and metal mesh expected to make up 11% of total transparent conductive film market in 2014

Silver nanowire (AgNW), Cu mesh, Ag mesh, and Ag halide, also known as indium tin oxide (ITO) alternatives, started being applied to products, replacing ITO film. It reflects the increasing application of capacitive touch panels, which allow for touch inputs by swiping a finger across the screen, while the existing ITO film has too high resistance to be employed in large-sized applications. The above-mentioned non-ITO films have low resistance relative to the ITO film, so they can allow capacitive touch panels to be employed for touch panels in which ITO cannot be used, and then to other applications. By film, Ag mesh is forecast to make up the largest 46% of the non-ITO film demand area, followed by Cu mesh with 25%. AgNW and Ag halide are expected to come next with 15% and 14%, respectively. Touch panel makers have been making aggressive investments in Ag mesh. Cu mesh has low resistance of below 10 ohm. Both AgNW and Ag halide are appealing to small-to-mid size applications, which put priority on thickness and flexibility.

The pie charts below break down the market shares of non-ITO films. Of the total transparent conductive film market demand area, non-ITO films are expected to account for 11% in 2014. They seem to be applied first to flexible displays and large-sized applications in which ITO films cannot be used, and then to other applications. By film, Ag mesh is forecast to make up the largest 46% of the non-ITO film demand area, followed by Cu mesh with 25%. AgNW and Ag halide are expected to come next with 15% and 14%, respectively. Touch panel makers have been making aggressive investments in Ag mesh. Cu mesh has low resistance of below 10 ohm. Both AgNW and Ag halide are appealing to small-to-mid size applications, which put priority on thickness and flexibility.

This report deals primarily with metal mesh and AgNW that have started being adopted as non-ITO films. They are compared with the solutions of ITO film, which represents the majority of the transparent conductive film market now. Strengths and weaknesses of each non-ITO film are analyzed in various aspects, including process technology, value chain and performance. The results are used as the basis of market forecasts for those films. This report is expected to be the guidelines as to how to raise competitiveness in the current touchscreen panel market, which has set its sight on ITO.
Table of Contents

I. Touch panel market and industry
1. Report overview
   1.1. Research objectives
   1.2. Research methodology
   1.3. Research scope and definitions
2. Touch panel market forecast
   2.1. Overall touch panel market forecast: Revenue
   2.2. Overall touch panel market forecast: Unit and area
3. Touch panel penetration rate
4. Projected capacitive touch layer structure
   4.1. Categorization and definition of projected capacitive touch layer structure
   4.2. Representative models of each projected capacitive touch layer type
   4.3. Application development and forecast by projected capacitive touch layer type
   4.4. Advantages and disadvantages by touch layer type used in small-sized applications (Smartphone)
   4.5. Advantages and disadvantages by touch layer type used in the mid- and large-sized applications
5. Market forecast by sensor type (glass, film, hybrid, embedded)
6. Issues and development trends of film-based touch sensor
   6.1. Development trends of projected capacitive touch panel
   6.2. Narrow bezel
   6.3. Emergence and growing demand of single layer touch technology
   6.4. Growing penetration rate of single-film sensor touch panel
   6.5. Growing demand for slim film sensor
   6.6. Growing film sensor market with lower resistance
   6.7. Meeting demand for flexible displays – Introduction of curved displays

II. Transparent conductive film market and industry
1. Types of transparent conductive film
2. Characteristics of metal-based transparent conductive film (ITO, AgNW, metal mesh)
3. Summary of non-ITO film characteristics
4. Application trends by transparent conductive film
5. Transparent conductive film application trends
   5.1. Currently available products with non-ITO films
   5.2. Touch sensor/transparent conductive film application trends by major brand
6. Transparent conductive film market forecast
   6.1. Overall market forecast (ITO + Non-ITO)
   6.2. Non-ITO market forecast
   6.3. Non-ITO film growth rate
   6.4. Demand forecast of non-ITO films by size group
   6.5. Non-ITO film market forecast by film type
   6.6. Market forecast of each non-ITO film type by size group

III. Silver nanowire
1. AgNW manufacturing process
   1.1. AgNW film manufacturing process
   1.2. Manufacturing process technology to reduce contact resistance
   1.3. Wet etching
   1.4. Direct laser patterning
   1.5. Comparison of etching methods: Wet etching vs. DLP
2. Issues and challenges with AgNW
   2.1. Securing pattern visibility: Wet etching
   2.2. Securing pattern visibility: DLP
   2.3. Narrow bezel
   2.4. Haze/Milky
   2.5. GFxy type AgNW film development (Single-side 2 layer conductive layer type)
   2.6. Hybrid between AgNW and other conductive materials
   2.7. Hybrid of AgNW and CNT
   2.8. Major players in the AgNW film industry
3. Key manufacturers
   Cambrios, Carestream, LG Electronics (CEM Business Division), Hyosung, Nano Chem Tech, E&H, Nanopyxis, n&b, 3M, UniDisplay, Sangbo, Innova Dynamics, Elcomtec, WIA Corporation
IV. Metal mesh
1. Metal mesh manufacturing process
   1.1. Ag mesh manufacturing process
   1.2. Ag halide manufacturing process
   1.3. Cu mesh manufacturing process (Photolithography, gravure offset, chemical Cu plating)
   1.4. Comparison of processes and characteristics
2. Issues and challenges with metal mesh
   2.1. Moiré
   2.2. Starburst and pattern visibility issues
   2.3. Double-side patterning (GF2)
3. Major manufacturers
   Toppan, DNP, LG Innotek, LG Chem, O-film, Mirae Nanotech, Synopex, Atmel, Cima Nano Tech,
   Poly IC, Inktec, Trais, J touch, Kumho electric, UniPixel, Panasonic, Mitsubishi Paper Mills Limited,
   Fujifilm, Gunze, KETI, Toray KP Film, Rolith, i-KAIST

V. Comparison of transparent conductive film competitiveness and analyst insight
1. Competitiveness of non-ITO films
   1.1. Lower resistance and falling price of ITO film
   1.2. Opportunities for non-ITO films by application
   1.3. Difference in value chains by transparent conductive film
   1.4. Comparison of touch sensor manufacturing flows
   1.5. Comparison of processes by transparent conductive film
   1.6. Optical property issues and solutions by transparent conductive film
   1.7. ITO film sensor price trends
2. Comparison of transparent conductive film competitiveness
   2.1. Comparison of ITO film, AgNW, metal mesh characteristics
   2.2. Comparison of applications (10 inches and below)
   2.3. Comparison of applications (larger than 10 inches)
   2.4. Competition in touch panel industry

VI. Appendix
1. Comparison of major transparent conductive film specifications
   Panasonic, Toppan, Toray KP Film, LG Chem, UniPixel, Gunze, LG Innotek, Mirae Nanotech, Fujifilm,
   Mitsubishi Paper Mills Limited, Hyosung, LG Electronics, Carestream