With the release of Windows 8, demand for the mid- and large-sized touch-screen panels is surging. The GFF touch panel that uses two sheets of ITO films under a cover glass has been mainly used for mid and large sizes. However, due to the Chinese government’s restriction on the production of indium, the main material of ITO film, the price of the film hiked. Hence, the touch panel industry is trying hard to gain price competitiveness of particularly large-sized touch panels.

No wonder the touch panel industry has been trying to replace ITO, which accounts for about 40% of the touch screen production costs, with metal mesh, Ag nanowire, carbon nanotube (CNT), or graphene for the past few years. Of them, metal mesh is considered the strongest candidate. It has a low resistivity like any other metals, but it also has a very low light transmittance. Yet, companies are manufacturing electrode films by finely coating a metal mesh, which is only a few micrometer wide, narrow enough to be almost invisible, on a transparent substrate of glass or plastic. The metal mesh film that can replace ITO film is not only price competitive but also applicable to flexible display touch panels, which ITO could not be applied to as it cracks. Thus, the metal mesh is expected to be the next-generation conductive film material.

Characteristics of Next-Generation Transparent Electrode Materials

<table>
<thead>
<tr>
<th>Materials</th>
<th>PEDOT:PSS</th>
<th>CNT</th>
<th>Graphene</th>
<th>Metal Grid</th>
<th>TCO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro</td>
<td>- Flexibility - Roll-to-roll process - Simple process</td>
<td>- Flexibility - Stability in air - Simplistic coating</td>
<td>- High mobility - Flexibility</td>
<td>- Low resistivity - Flexibility</td>
<td>- Low resistivity - High transmittance - Yellow-orange materials - Matured process - Low cost TCO</td>
</tr>
</tbody>
</table>

Analysis of Patent Application Trend

In total, 248 patent applications were filed in the U.S. on the conductive film technology. In 1974, Hitachi applied for the first of its kind, and the number of applications has increased sharply, by a CAGR of 21% from 1999 to 2010. Since 2011, Samsung Electro-Mechanics, Fujifilm and 3M have actively applied for patents on the technology. (*Patents are published 18 months after the application; as a result, the number of patent applications is underestimated after 2011: Invalid period.).

Implication

The metal mesh technology is projected to emerge as the technology to replace the ITO film particularly in the mid- and large-sized touch panels. The leading companies in the industry have already patented their own technologies for the past few years. Thus, not only the leading companies but also those who are planning to enter the market should regularly monitor newly published or issued patents and thoroughly analyze them to come up with prompt and flexible strategies to cope with possible patent disputes.
Lead Analyst

Dani Kim - Principal Analyst

Dani Kim is responsible for the analysis of display industry and technology patents at IHS. Dani has more than 10 years of experience in patent research and analysis of the display industry. He has published a number of reports on patent analysis, particularly regarding LCD, OLED, and semiconductor manufacturing equipment.

He also creates monthly Patent Watch market brief, primarily on touch sensor technologies, that analyzes new patents, key technology/product patents, and patent disputes.

Prior to joining IHS in 2011, Dani led a patent team at DMS Ltd., a company that manufactures display and semiconductor equipment in South Korea. He also has a great deal of experience with technology valuation and writing patents.

Dani received a Bachelor’s degree in Mechanical Engineering from Kumoh National University of Technology.

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