



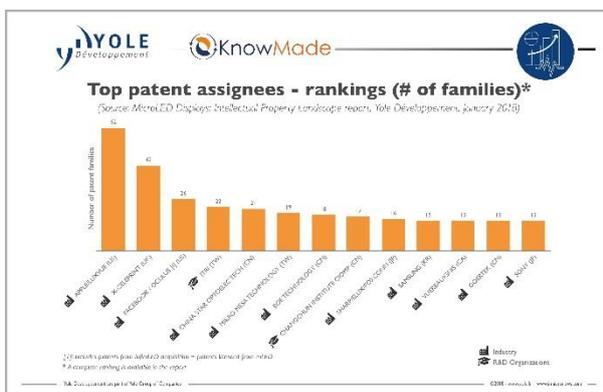
## FOR IMMEDIATE RELEASE:

### MicroLED displays: the patent landscape reflects the dynamism of the sector

Extracted from: MicroLED Displays : Intellectual Property Landscape report, Yole Développement & KnowMade – January 2018

**LYON, France – January 31, 2018:** This year again, the Las Vegas Consumer Electronics Show, 2018 edition allowed us to discover the latest innovations in numerous fields including the microLED displays sector. “The Wall”, a 146” microLED TV powered by Samsung, has been probably the most impressive announcement. The Korea-based LED<sup>1</sup> maker Lumens also proposed a 139” display, with smaller 0.8 mm pitch. In both cases, technology developed by these leaders is not strictly microLED related but confirms the attractiveness of microLEDs solutions. **Yole Développement’s (Yole) analyst, Dr. Eric Virey** attended the show and proposed a snapshot [on i-micronews.com](http://on_i-micronews.com).

“Initial success in smartwatches could accelerate technology and supply chain maturation, making microLED competitive against OLED<sup>2</sup> in high end TVs, tablets and laptops”, explains Dr. Eric Virey from Yole. “In Yole’s most optimistic scenario, the market for microLED displays could reach up to 330 million units by 2025<sup>3</sup>.”



The microLED display sector has been deeply analyzed by Yole and [KnowMade](#), both parts of Yole Group of Companies. The partners propose today a detailed patent analysis titled: [MicroLED Displays: Intellectual Property Landscape](#). Under this new report, they identified key patents, technology nodes and players related to microLED technologies for display applications. This latest analysis confirms the growing interest around the microLED technologies.

Which companies own the patents? What are their major thrust areas and portfolio strength? Yole Group of Companies invites you to discover the latest insights of this dynamic industry.

Yole Group of Companies confirms the buzz: as of today close to 1,500 patents relevant to the microLED display field have been filed by 125

<sup>1</sup> LED: Light Emitting Diode

<sup>2</sup> OLED: Organic Light Emitting Diode

<sup>3</sup> Source : [MicroLED Displays](#) report, Yole Développement, 2017

companies and organizations. Among these are multiple startups, display makers, OEMs<sup>4</sup>, semiconductor companies, LED makers, and research institutions.

“The overall corpus is relatively young, with an average age of 3.2 years across all families”, asserts **Dr. Nicolas Baron, CEO & Founder, KnowMade**. The first patents were filed in 2000 - 2001, but the bulk of the activity started after 2012. Thus, only a minority of patents have been granted so far.

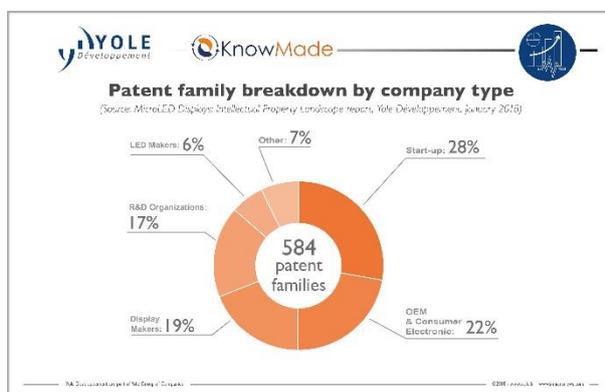
Pioneers include Sony, Sharp, MIT, and others, although the bulk of the initial developments were conducted by a variety of research institutions including Kansas State University, University of Hong Kong, Strathclyde University & Tyndall Institute (which spun-off mLED, InfiniLED, and X-Celeprint), University of Illinois, and startup companies like Luxvue and, later on, Playnitride and Mikro Mesa.

Yole Group of Companies’ study also reveals a number of companies that have not yet been identified as players in the microLED display field. Moreover, this study confirms the commitment of many more companies, which are not typically associated with display technology. Intel and Goertek are part of them. On the flip side, various companies known to be active in the field (i.e. Huawei) have yet to see any of their patent in the field published.

Overall, the activity is still led mostly by startups (including those such as Luxvue or eLux) acquired by larger organization) and research institutions. With the exception of Sharp and Sony, display makers and LED makers are relative latecomers. Many companies started ramping up their microLED research and development activities after Apple showed faith in microLED with its acquisition of Luxvue. As of December 2017, Apple appears to have the most complete IP<sup>5</sup> portfolio, covering almost all key technology nodes. However, many of its patents pertain to the technological ecosystem developed around the company’s MEMS<sup>6</sup> transfer technology. Other companies like Sony, with a smaller portfolio but which had a head start, might own more

fundamental design patents with strong blocking power.

What is the status of the microLED display supply chain? Enabling large-scale microLED display manufacturing requires bringing together three major disparate technologies and supply chain bricks: LED manufacturing, backplane manufacturing, and microchip mass transfer & assembly.



<sup>4</sup> OEM : Original Equipment Manufacturer

<sup>5</sup> IP : Intellectual Property

<sup>6</sup> MEMS : Micro Electro Mechanical Systems

*“The supply chain is complex and lengthy compared to typical displays,”* comments **Dr. Eric Virey from Yole**. *“Every process is critical and it’s a challenge to effectively manage every aspect. No one company appears positioned to master and execute across a supply chain that will likely be more horizontal, compared to other established display technologies.”*

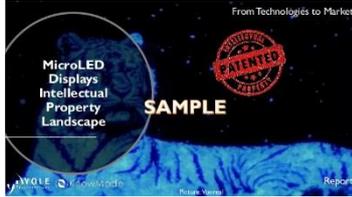
The IP landscape reflects these challenges through the variety of players involved, but requirements differ from one application to another. For low-volume, high added-value applications like microdisplays for augmented/mixed reality for the enterprise, military, and medical markets, one can envision a well-funded startup with good technology efficiently managing the supply chain. However, consumer applications such as TVs and smartphones will require significant investments to unlock large scale manufacturing.

Though only a few companies have a broad IP portfolio covering all major technology nodes (transfer chip structure, display architecture, etc.), enough players have patents across many technology bricks to guarantee that complex licensing and legal battles will arise once microLED displays enter volume manufacturing and reach the market. Small companies with strong positions in various technology bricks will attempt to obtain licensing fees from larger players involved in manufacturing. Large corporations will try to block each other and prevent their competitors from entering the market. To prepare for such events, some latecomers appear to be filing large quantities of patents, sometimes with little substance.

[Microled Displays: Intellectual Property Landscape](#) report is part of a large collection of displays reports. Full list of reports and detailed descriptions are available on [i-micronews.com](http://i-micronews.com), [displays reports section](#).

**ABOUT THE REPORT:****MICROLED DISPLAYS: INTELLECTUAL PROPERTY LANDSCAPE**

*What are their major thrust areas and portfolio strength?* – Produced by KnowMade & Yole Développement

**Companies cited in the report:**

3M, Aledia, Apple/Luxvue, Atom Nanoelectronics, Au Optronics, Bai Hangkong, Beijing University Of Technology, BOE Technology, CEA, Changchun Institute, CIOMP, CNRS, Columbia University, Cooledge Lighting, Corning, Cree, CSOT, Delta Electronics, Emagin, ETRI, Facebook-Oculus, Focus Lightings Technology, Fraunhofer, Fudan University, Fuzhou University, Glo, Goertek, Google/X Development, Guangdong Poly Optoelectronic, Hahotech, HC Semitek, Epilight, Hiphoton, JD Display, Huawei, III-N Technology, Innolux, Intel, ITRI, Itswell, Jasper Display, Jiangsu Xinguanglian Semiconductor, Junwan Microelectronic Technology, KAIST, Kansas State University, KIMM,... [Full list](#)

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- **Dr. Eric Virey** serves as a Senior Market and Technology Analyst at Yole Développement (Yole). Eric is a daily contributor to the development of LED, OLED, and Displays activities, with a large collection of market and technology reports as well as multiple custom consulting projects. Thanks to its deep technical knowledge and industrial expertise, Eric has spoken in more than 30 industry conferences worldwide over the last 5 years. He has been interviewed and quoted by leading media over the world. Previously Eric has held various R&D, engineering, manufacturing and business development positions with Fortune 500 Company Saint-Gobain in France and the United States. Dr. Eric Virey holds a Ph-D in Optoelectronics from the National Polytechnic Institute of Grenoble.
- **Dr. Nicolas Baron** is CEO and cofounder of Knowmade. He manages the development and strategic orientations of the company and personally leads the semiconductor department. Nicolas has more than 10 years-experience in semiconductor related patent & technology analysis. Previously Nicolas was research assistant at the French research laboratory CRHEA-CNRS where he worked on the development of a new generation of GaN-on-Silicon transistor for power and RF applications. Dr. Nicolas Baron holds a Ph-D in Physics from the University of Nice Sophia-Antipolis, and a Master of Intellectual Property Strategies and Innovation from the European Institute for Enterprise and Intellectual Property (IEEPI), Strasbourg, France.

**ABOUT KNOWMADE**

Knowmade is a Technology Intelligence and IP Strategy consulting company specialized in analysis of patents and scientific information. The company supports R&D organizations, industrial companies and investors in their business development by helping them to understand their IP environment and follow technology trends. KnowMade is involved in Compound Semiconductors, Power Electronics, RF & Microwave Technologies, LED/OLED Lighting & Display, Photonics, Memories, MEMS & Sensors, Manufacturing & Advanced packaging, Batteries & Energy management, Biotechnology, Pharmaceuticals, Medical Devices, Medical Imaging, Agri-Food & Environment.

Knowmade's experts provide prior art search, patent landscape analysis, scientific literature analysis, patent valuation, IP due diligence and freedom-to-operate analysis. In parallel the company proposes litigation/licensing support, technology scouting and IP/technology watch service. Knowmade's analysts combine their technical and patent expertise by using powerful analytics tools and proprietary methodologies to deliver relevant patent analyses and scientific reviews.

More info on <http://www.knowmade.com> and follow Knowmade on [Linkedin](#).

**ABOUT YOLE DEVELOPPEMENT**



Founded in 1998, Yole Développement has grown to become a group of companies providing marketing, technology and strategy consulting, media and corporate finance services, reverse engineering and reverse costing services and well as IP and patent analysis. With a strong focus on emerging applications using silicon and/or micro manufacturing, the Yole group of companies has expanded to include more than 80 collaborators worldwide covering MEMS and image

sensors, Compound Semiconductors, RF Electronics, Solid-state lighting, Displays, software, Optoelectronics, Microfluidics & Medical, Advanced Packaging, Manufacturing, Nanomaterials, Power Electronics and Batteries & Energy Management.

The “More than Moore” market research, technology and strategy consulting company Yole Développement, along with its partners System Plus Consulting, PISEO and KnowMade, support industrial companies, investors and R&D organizations worldwide to help them understand markets and follow technology trends to grow their business. . For more information, visit [www.yole.fr](http://www.yole.fr) and follow Yole on [LinkedIn](#) and [Twitter](#).

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