Press Release
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LYON, France

A bright future? Displays and optic innovations transform the AR & VR industries[1]

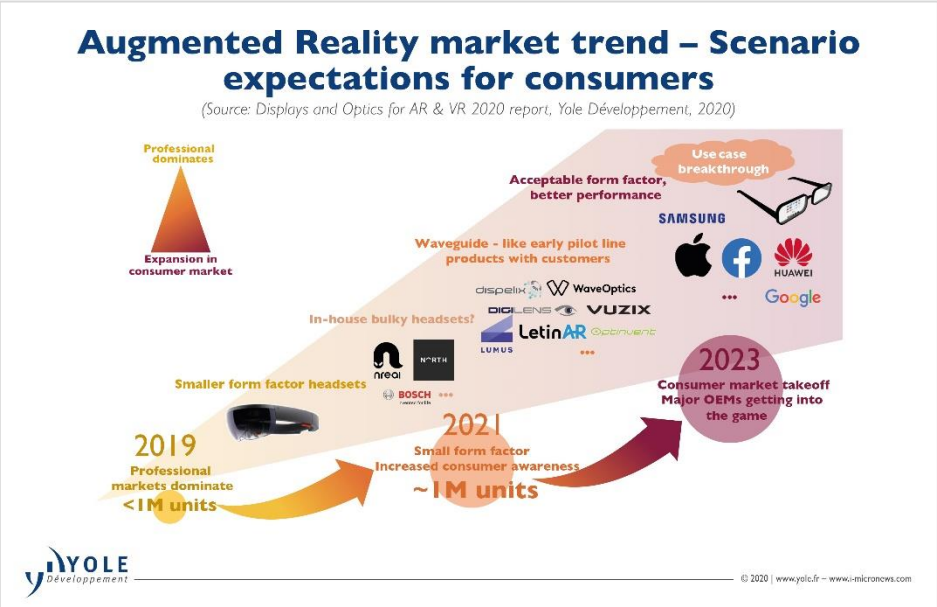
OUTLINES:

- Technology status for AR[2] & VR[3]: optics is getting ready. MicroLED displays are the next roadblock.
- OEM[4]s are waiting for MicroLED-based innovations. Yole Développement anticipates MicroLED's penetration to reach 30% in AR headsets by 2027.
- A 1st generation of AR headsets to come soon with a 2021 milestone showing noticeable volume.
- Supporting an attractive 105% CAGR[5] for AR headsets through 2027, a dedicated supply chain is emerging with new players and new strategies to handle key manufacturing challenges.

From **Zine Bouhamri, PhD, Technology & Market Analyst, Displays at Yole Développement (Yole)**: *"AR was and continues to be the dream that consumer electronics companies want to make real to deliver the long-awaited revolution of replacing smartphones. But as children of the flat panel display industry, we are used to having very high-quality displays all around us. And the image quality that AR has been able to provide so far is not yet at this level. Technology improvements such as waveguide optics and microLEDs will enable an increase in functionalities and use case developments. Without a compelling use case, the consumer will not jump into the game".* The market research & strategy consulting company, Yole, analyzes this progress in a new dedicated display report, titled Displays and optics for AR & VR 2020. Yole offers a comprehensive overview and in-depth understanding of the displays and optics markets associated with these industries. This report analyzes the key challenges related to AR & VR systems and the future trends and evolution of AR & VR market landscapes. This study also

[1] Extracted from : Displays and optics for AR & VR 2020, Yole Développement
[2] AR : Augmented Reality
[3] VR : Virtual Reality
[4] OEM : Original Equipment Manufacturers
[5] CAGR : Compound Annual Growth Rate

points out the related industrial and technological ecosystems, associated roadmaps, market forecasts, and much more.



Indeed, Yole's analysts expect a first generation of headsets to come soon, with a 2021 milestone of a noticeable volume. These will be based on conventional optics with most likely either MEMS[6] or OLED-on-silicon display solutions. However, for the market to really be enabled, a complete technological paradigm shift is required. In terms of optics, everything revolves around waveguide technologies. For a long time they have been improving and were fighting against the poor optical efficiency they could deliver.

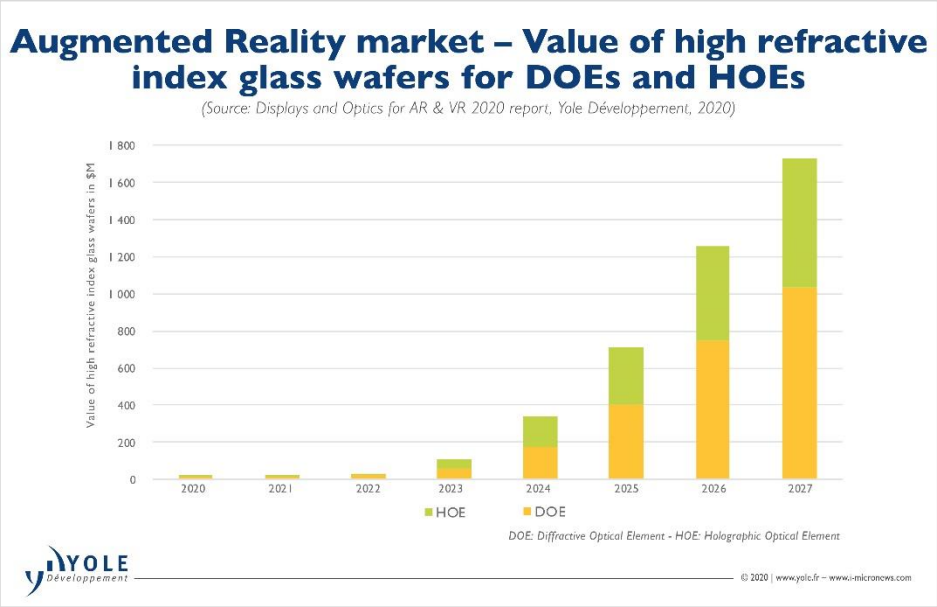
According to **Zine Bouhamri**: *"From less than 1% efficiency we can now see results that go an order of magnitude beyond that. So much so that, while uniformity needs to be improved, they meet the minimum requirements for OEMs. We expect a second milestone around 2023 when the big consumer electronics brands come in with a product that respects the consumer requirement trio of performance, cost and form factor".*

But one element is still missing at the moment: the display engine. Though efforts are continuing, Yole's analysts have not yet seen a microLED product. MicroLED microdisplays can provide what the other solutions cannot, brightness, form factor, color, and contrast. And all the OEMs are waiting for this opportunity to materialize, as Yole anticipates its penetration to reach 30% by 2027.

"The AR market has been mostly a professional-based market, as the performance, cost and form factor trio is hard to balance" says **Pierrick Boulay, Technology & Market Analyst, Solid-state Lighting at Yole**. *"But thanks to all the technological advancements, we can expect a 105% CAGR through to 2027 in volume for AR headsets. And this promise of a strongly growing market has sparked the interest of many in the supply chain, some still in stealth mode".*

[6] MEMS : Microelectromechanical Systems

Indeed, waveguides have improved a lot thanks to design efforts but also thanks to the push from equipment makers intensifying their efforts, such as EV Group and Oxford Instruments and the substrate manufacturers. The glass industry has been working at providing high refractive index wafers to allow for waveguide manufacturing, trying to both push and enable the market. Given the projected wafer numbers and associated revenues, were the consumer market to thrive, it would represent a non-negligible portion of the glass business.



But for the consumer market to thrive, it is about more than just the hardware and providing a high-quality image in something that looks like a regular pair of glasses. If the end-result simply consists of putting a smartwatch screen in front of the eye, this is probably not compelling enough. Much like VR, there is a need for a real disruption in the use case. That is why we expect the OEMs to come in with a proper proposition to really kickstart the market. As with the history of the smartwatch, we think the adoption curve for AR will follow the same path, with the early products maybe not providing compelling performance and use case, until a big gun jumps in. As an example, Apple seems like a good candidate for that: they have the microLED effort, the waveguide effort, the application effort with ARKit and also the 3D sensing effort. As they progressively integrate some of these technologies in their newer products, they will raise awareness about AR, preparing the consumer for when everything is ready for a headset. And perhaps that will be seen by 2023.

Throughout the year, Yole Développement, publishes numerous displays and optics-related reports. Make sure you are aware of the latest news coming from the industry and get an overview of our activities, including interviews with leading companies, analyses from our experts and dedicated online and onsite events on i-Micronews.

Press Release

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About our analysts

As a Technology & Market Analyst, Displays, **Zine Bouhamri**, PhD, is a member of the Photonics, Sensing & Display division at Yole Développement (Yole). Zine manages the day to day production of technology & market reports, as well as custom consulting projects. He is also deeply involved in the business development of the Displays unit activities at Yole. Previously, Zine was in charge of numerous R&D programs at Aledia. During more than three years, he developed strong technical expertise as well as a detailed understanding of the display industry. Zine is author and co-author of several papers and patents. Zine Bouhamri holds an Electronics Engineering Degree from the National Polytechnic Institute of Grenoble (France), one from the Politecnico di Torino (Italy), and a Ph.D. in RF & Optoelectronics from Grenoble University (France).

As part of the Photonics, Sensing & Display division at Yole Développement (Yole), **Pierrick Boulay** works as Market and Technology Analyst in the fields of Solid-State Lighting and Lighting Systems, carrying out technical, economic and marketing analyses. Pierrick has authored several reports and custom analyses dedicated to topics such as general lighting, automotive lighting, LiDAR, IR LEDs, UV LEDs and VCSELs. Prior to Yole, Pierrick has worked in several companies where he developed his knowledge on general lighting and on automotive lighting. In the past, he has mostly worked in R&D departments on LED lighting applications. Pierrick holds a Master's in Electronics (ESEO – Angers, France).

About the report

Displays and optics for AR & VR 2020

Optics is getting ready - now MicroLED displays are the next roadblock for the implementation of augmented reality. - Performed by Yole Développement

Companies cited:

4th Dimension Displays, Agc, Akonia Holographics, Aledia, Apple, Auo, Avegant, Bayer, Boe, Bosch, Canon, Castar, Ceres Holographics, Colour Holographic, Compound Photonics, Corning, Daqri, Dell, Digilens, Dispelix, Emagin, Facebook, Finisar, Fove, Fraunhofer, Glo, Google, Holoeye, Hoya, HP, HTC, Idealens, Inkron, Intel, Itri, Jade Bird Display, Jdi, Konica Minolta, Kopin, Leap Motion, Lenovo, Letinar, LG, Limbak, Linq, Liteon, Luminit, Lumiode, Lumus, Magic Leap, Meta, Micledi, MicroLED, Microsoft, Mira, Molecular Imprints, Nintendo, Nvidia, Oakley, Oculus, Ohara, Olightek, Optinvent, Ostendo, Osterhout Design Group, Pico, Pimax, PlayNitride, Plessey Semiconductors, Pupil Labs, Qualcomm, Raontech, Razer, Rockwell Collins, Samsung, Schott, Sega, Seiko Epson, Sony, Starbreeze, Sumita, Syndiant, Texas Instruments, Theeyetribe, Tooz, Valve, WaveOptics, Young Optics and many more

Related reports :

- MicroLED Displays – Intellectual Property Status & Landscape 2020
- 3D Imaging & Sensing 2020
- MicroLED Displays 2019
- Status of the MEMS Industry 2019
- Magic Leap One – Augmented Reality Headset

About Yole Développement

Founded in 1998, Yole Développement (Yole) 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. 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… More

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