Phosphors & Quantum Dots for LED Application Patent Landscape

Description: The last 2 years have seen some major changes on the LED market with important boom of lighting applications and the growth of Chinese LED industry. On the phosphor front, nitrides are the dominant red phosphors for high CRI lighting and wide color gamut displays. Suppliers have proliferated despite IP restrictions. But a new material, Mn4+ doped PFS (potassium fluorosilicate) developed by GE and already manufactured by Denka, Nichia, GE and others could challenge the dominance of nitrides in display applications thanks to its extremely narrow band. Quantum Dots (QDs) have also emerged as highly credible options for displays thanks to design flexibility (adjustable emission wavelength) and very narrow band emission. YAG is the best yellow phosphor for white LEDs. But its use is restricted by strong IP owned by Nichia. Silicates are the best substitute but still lag slightly in performance. With critical IP to start expiring from 2017 and prices significantly lower than any alternative, we expect YAG to become ubiquitous by the end of the decade and silicate to decrease significantly unless breakthrough in performance and cost are achieved. Phosphor IP is a major force in LEDs and contributed heavily in shaping its industry with more than 70 litigation cases involving around 50 companies.

The LED industry keeps bracing for the expiration of many fundamental patents. This could help relative newcomers such as Chinese LED packaging companies expand their market overseas. In the meantime, Everlight has been accentuating its effort to invalidate most of Nichia's fundamental patents and Osram and Nichia have continued strictly enforcing their IP via multiple litigations while the BOSE consortium has expended its licensing program for Silicate phosphors to various Chinese LED packaging companies.

More than 7,510 patented inventions related to Phosphors & QDs have been published worldwide up to September 2015. The first patents were published by Japanese companies (Mitsubishi, Toshiba, Nichia, NIMS, Panasonic...). But patenting activity really took off over the 2003-2007 period after development of first high brightness GaN-based blue LED from Nichia. A second wave of patent publications started in 2010, mainly originating from AOT, Samsung and Stanley Electric. The increase in patent publications focused on Phosphor Composition follows same trend although more slowly. Chinese LED phosphor players such as Sunfor Light have recently entered the LED Phosphors & QDs IP arena.

Overall, patent filings peaked in 2013, and have been slowing down since. Meanwhile, granted patents worldwide should increase after successful processing of the numerous pending patent applications. We expect patent filings to continue driven by innovation in nitride phosphors or new compositions such as Mn4+ activated phosphors or QDs that haven't reached their technology maturity yet and for which adoption in commercial applications such as displays is just starting.

Contents:
1. Introduction
   - Scope of the Report
   - Key Features of the Report
   - Objectives of the Report
   - Methodology
   - Search Strategy
   - Segmentation of Patents
   - Technological Segmentation
2. Executive Summary
3. Status of the LED Industry
4. Phosphor Market Overview
5. Quantum Dots Market Overview
6. Phosphors & QDs IP Overview
   For each segment (LED wavelength conversion,Phosphor composition, Remote phosphors, Quantum dots):
   - Time Evolution of Patent Publications
7. Phosphor Compositions
For each composition (Garnets, Silicates, Nitrides, New compositions):
- Time Evolution of Patent Publications
- Table Phosphor Compositions v.s. Assignees
- Main Patent Assignees Ranking
- Time Evolution of Patent Assignees
- Patent Assignees IP Network
- Degree of Specialization of Patent Assignees
Focus on Nitrides/Oxynitrides
Focus on New Compositions
For each focus:
- Overview
- Time Evolution of Patent Publications
- Mapping of Main Current IP Holders
- Mapping of Main Current IP Applicants
- Leadership of Patent Assignees
- Impact Factor of Patent Portfolios
- Strength Index of Patent Portfolios
- IP Blocking Potential of Assignees
- Key Patent Families
- Potential Future Plaintiffs

8. Quantum Dots
- Overview
- Time Evolution of Patent Publications
- Mapping of Main Current IP Holders
- Mapping of Main Current IP Applicants
- Main Patent Assignees Ranking
- Time Evolution of Patent Assignees
- Countries of Filing for Main Patent Assignees
- Patent Assignees IP Network
- Degree of Specialization of Patent Assignees
- Leadership of Patent Assignees
- Impact Factor of Patent Portfolios
- Strength Index of Patent Portfolios
- IP Blocking Potential of Assignees
- Key Patent Families
- Potential Future Plaintiffs

9. Focus on QD Compositions (Cd v.s. Cd-free)
- Overview
- Time Evolution of Patent Publications
- Main Patent Assignees Ranking
- Time Evolution of Patent Assignees
Focus on China
- Overview
For each segment (LED wavelength conversion, Phosphor composition, Remote phosphors, Quantum dots):
- Time Evolution of Patent Publications
- Main Patent Assignees Ranking
- Time Evolution of Patent Assignees

10. Litigations & Licensing Landscape
- Chronology of Major Events
- Litigation Plaintiffs and Defendants
- Patents Families Most Cited in Infringement Litigations
- Litigated Patent Families
- Litigation – Time Histogram
- Litigation date vs. Priority Date
- Litigation Strategies
- Chronology
- Licensing: Historical Events (1996-2012)
- Licensing: Recent Events (2013-2015)
- Licensing: Focus on Silicates and the BOSE Consortium
- Licensing: Focus on Nitrides
- Invalidation Attempts
- Conclusion

Focus on The Everlight – Nichia Patent War
Expiring Patents Analysis
Conclusions

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