Quantum Dots Firmly Established as Mainstream Display Tech

Las Vegas International Consumer Electronics Show (CES) - January 2016

We have just returned from another whirlwind tour of the infamous International Consumer Electronics Show (CES 2016) held each January in Las Vegas, NV and as usual this year's conference was both fun and a bit hectic with just a little over 30 hours on the ground to pack in a full slate of meetings and get around to all the major OEM booths in the flat panel display sector (with one hour taxi lines everywhere, just getting from one venue to another is tough!). If you had a chance to read our QTMM Travel Digest for CES 2015 you likely took away from that article that quantum dot technology was moving ahead quickly to become a primary addition to flat panel display technology as a cost effective tool to "stretch" the color rendering capability of a standard LCD flat panel and
produce measurably wider color gamuts. If CES 2015 marked the key "break out" moment for quantum dots, we are going on record here that the 2016 CES Conference will be remembered as the year that this game changing nano-material went mainstream in LCD panel design. Based on what we just witnessed at CES, we will go even a step further here and predict that in the very near future, quantum dots will become "SOP" in the vast majority of not only flat panel TV's, but will quickly migrate into the computer monitor and laptop markets to enrich the color rendering capability of these massive consumer electronics' categories as well.

While there was much evidence at this year's CES to support this tectonic shift in LCD panel design, the sea change nature of this technology revolution was made crystal clear during Samsung's presser on Tuesday wherein they announced that they were following up their highly successful 2015 SUHD line of quantum-dot enabled flat panels with an even broader series of SUHD panels (from 49" to 88") - all powered with "cadmium-free" quantum dots. Samsung's presentation focused on the power of quantum dots and how they enable "brighter, more lifelike images without distortion and without compromising brightness levels" and further stated in the press conference that "at Samsung, we believe it is the future of display technology".

Strong words for sure but Samsung backed up these bold statements with an array of stunning quantum dot powered demonstrations and displays on their main display floor that went well beyond last years' SUHD models in displaying jaw dropping picture quality and absolutely life-like wide color gamut (WCG) capability - all made possible with the unique and highly efficient super material known as quantum dots. In fact, the presence of quantum dots in Samsung's massive display floor was so pronounced, one could easily have thought they had made a wrong turn and stumbled onto the display floor of a Company named simply "quantum dots". In addition to quantum dot technology this year's CES served as strong validation that both 4K (UHD) and HDR (High Dynamic Resolution) are going mainstream in 2016 LCD panel design and the "packaging" of these three complimentary technologies is now moving out in front to quickly capture the lion's share of the flat panel display market - and based purely on the quality gap that is now strikingly clear between "standard non UHD, non WCG product, non HDR capable" panels.
and this markedly better "next level" display technology - we believe (as do several other industry players we spoke with at CES) that OEM's that fail to rapidly adapt to this paradigm shift in LCD design will be left quickly behind and their products will gather thick coats of dust on store shelves as this new breed of LCD panel drives the much anticipated and sought after "product replacement cycle" - a market condition that can only be created if the next generation display product line is materially better than what consumers already own, and the price to upgrade is not significantly higher than what the "mass consumer" is willing to pay for the upgrade. Based on the reactions to quantum dot displays from many CES attendees (and OEM's) we saw this year, it was obvious to us that this Rubicon moment has now been crossed.

https://www.youtube.com/watch?v=dmjziiSo1os

In addition to viewing the Samsung displays, we did get around to most of the other major OEM's displaying their lineup for 2016 and beyond and we saw plenty of quantum dot powered displays from Hisense, TCL and a host of others looking to cash in on this new up-shift in quality at low cost differentials using existing fab infrastructure capacity. As expected, the LG display floor was very OLED centric and yes - as advertised, these displays are extremely high in viewing quality. In contrast to the Samsung floor area, which was very well lit, the LG floor resembled the light level of a movie theater, with the house lights set very low to show off this technology's very strong contrast and extreme black levels. In fact, Samsung made an obvious "call out" to this situation in their
presser when they cited that their research showed that most consumers do not watch TV in totally dark rooms. While OLED technology can show extreme black levels and can be made both very thin and lightweight (again, "advantages" that we are not really sure moves the dial for most consumers when making a large, flat panel buying decision) - we still see plenty of signs here of high cost manufacturing due to the low yield, vapor deposition shadow-mask processing step (which becomes harder as the mother glass panel size increases). And while we have seen plenty of evidence of late that OLED is gaining some serious ground in the handheld market (there are even rumors that a next generation iphone in 2017/2018 could move to adopt an OLED screen, although there isn't even close to enough fab space without some major bucks being spent to make this happen), the technology's ability to effect the large format display market looks to be capacity constrained for some time to come until many billions of dollars of capital is invested in additional UHD-OLED large format fab capacity and the price points come down to match those of QD sets (we think it's going to be very tough to make both sides of that equation come true in an economically challenged industry environment). We did see several new OLED offerings from OEMs besides LG at CES such as the new OLED from Panasonic (LG supplied panel so not additional fab capacity coming on line) with an expected delivery date of mid 2016 in Europe (they did not have a date yet for North America release). The 65" Panasonic was striking like LG's OLED's but at the expected price point of MSRP $7,999.00, it better damn well be! Getting back to capacity for a moment, even with LG spending considerable capital to upgrade their WOLED (white OLED) capacity, they are projecting 2016 capacity of a little over one million finished panels (55" and larger) - which represents roughly one half of one percent (0.5%) of the flat panel display market. In contrast, we saw an estimate the other day that 2016 LCD UHD (4K) market penetration in 2016 could be in the 55 to 60 million panel category - and making any of these LCD's into a quantum dot powered TV is remarkably easy - just slip an extra sheet of QD infused film into the stack during the manufacturing process and you instantly move the color gamut up several notches and create a viewer experience that closely approaches (if not identically matches) that of the much more costly OLED sets - at a price that isn't that much more than "vanilla" UHD LCD price points. We know from this year's CES that Samsung is planning to push quantum dots into their entire large format SUHD line, and based on their success in the market this year, we expect many of the other OEM's to quickly to emulate this strategy as well.

In addition to visiting the OEM display booths, we also took some time to visit several of the other quantum dot players that were presenting at this year's show (we visited the Nanosys and QD Vision suites - Nanoco was not on the CES register or we would have visited them as well and it was noted that LG showed no QD sets at CES 2016 and when we asked demo reps if they had anything coming up with quantum dots we did not get an affirmative answer). There is no question that the other QD focused companies are helping OEM's build incredibly rich in WCG color, high performance products that incorporate quantum dots. One of the key takeaway's from visiting the QD Vision suite was a demonstration which showed the real-time power usage of a standard LCD screen vs. an LG OLED
As we have discussed in the past, this is a key advantage for quantum dots and should pave the way for quantum dots to move into the laptop market as a key value driver in extending battery life. The demo shown was for standard TV programming but when you look at the type of heavy "white space" viewing that is standard on laptops, the power advantage of QD sets will be even more pronounced. We also got to see several computer monitors powered by quantum dots that had just unbelievable color rendering capabilities. Just as TV's are not generally watched in pitch black rooms, laptops and monitors are generally watched in rooms with ample ambient lighting, which goes a long way in neutralizing OLED's key differentiating benefit of "jet black" contrast levels. Also, we learned that LCD's ability to produce naturally bright images (1,000 nit brightness was standard in Samsung's new SUHD line) gives them the edge driving HDR technology/content without burning a lot of extra power. When you consider the power usage benefits and the major MSRP cost differentials, (we heard about, but did not see a 30" Dell OLED prototype monitor listing at $5 GRAND! - ouch! can I get a discount if I buy 2? - in contrast, QD monitors should be very closely priced to existing LCD monitors) we expect both monitors and laptops to start showing up on shelves with wide color gamut screens powered by quantum dots - and just as in the fab capacity advantage of LCD TV displays in these two categories, the ability to instantly upgrade these formats by the addition of quantum dot film/components gives us confidence that market penetration will likely mirror that of "TV" displays' rapid uptake of quantum dots.

The reps we met at the other QD firms were great (even though we were wearing our Quantum Materials Corp badges!) and really took the time to walk us through their present slate of technology offerings - and while they are direct competitors of Quantum Materials Corp - I also look at them somewhat as allies in a collective mission to advance quantum dot technology into the mainstream for LCD design as well as eventually into solid state lighting, medical, solar and the myriad of other product sectors that will be disrupted by this new super material with "light bending" capabilities. Let's face it - from the looks of things this is going to be a HUGE market space and the companies that got started early - and have managed to bring forward innovative, technology advancing products all stand to benefit greatly as this market continues to advance at a blistering pace.

When you add monitors and laptops to the 200M plus/year displays built on a global basis, the total addressable market for quantum dots becomes truly MASSIVE and will require many, many tons of finished quantum dots to meet supply requirements. Therefore, based on how quickly this market looks to be developing, we see a situation occurring wherein the supply of quantum dots could be quickly outpaced by demand, a situation that would be
very desirable for all companies (and their equity shareholders) that are able to produce large volumes of high performance spec quantum dots.

As we have discussed in previous posts when trying to describe the difference between "quantum dot" color and "standard LCD" color it is difficult, if not impossible to put into words or even show this delta in pictures unless the device you are viewing those pictures/videos on is a WCG capable device. It's just one of those things that you really have to experience for yourself to really "get it". In addition to being a "visual" experience, it's also a "visceral" experience. This visceral experience was certainly obvious in the "goose bump" inducing Samsung Video Wall display area complete with high decibel, orchestra quality soundtrack and "eye widening" rich content (two of the graphics in this post link to streaming Samsung Video Wall demo videos), but it was likely most striking while watching a looped video of life-sized, very sketchy looking venomous pit vipers on a large screen WCG QD equipped 65" display in one of the suites. Your brain knows that it's just a flat panel display and you keep reminding yourself of this fact, but I'm telling you it's tough to fully relax while watching this display and even harder to move closer than about 5 or 6 feet to this screen. Like I said, it's difficult to truly appreciate this technology until you experience it for yourself! (and that's why these sets have, and will continue to fly off retail store shelves).

While Quantum Materials Corp. did not have products on display at this year's CES we do see them as being very, very close to being in that position, especially in light of a recent Joint Development Agreement with one of the world's largest flat panel display OEM's and more recently a funded Joint Development Agreement with leading global opto-electronic film group Nitto Denko (based in Japan) and predict that this will be the last year that we go to CES and don't see Quantum Materials Corp. displays in an OEM booth. Further to that point, QMC will be presenting at the upcoming Smithers Apex Quantum Dot Forum in Newport Beach in early March (March 9-11) and will also be presenting at the Roth Investment Conference, also in early March (March 13-16) in the Newport Beach area. Also, both quantum dots and Quantum Materials Corp. are starting to show up in more industry press articles and wanted to make sure everyone saw this recent article out by Jennifer Baljko of IHS Electronics 360 in late December which really captures well the current state of rapid growth in the quantum dot industry and where this looks to be headed in the near future: http://electronics360.globalspec.com/article/6133/shining-a-light-on-quantum-dots and here is another recent article from Matthew Brennesholtz at Display Daily that references Quantum Materials Corp and how quantum dots looks to be widening the gap on other promising new materials such as perovskites:

Like last year, we had the chance during this year's CES conference to catch up with several members of the Quantum Materials Corp. team that were attending this year including: CEO Stephen Squires (photo to right); VP Asian Business Development Toshi Ando; Director of Marketing Art Lamstein; Director Ray Martin; PR consultant Rich Schineller as well as several long term shareholders that had made the journey down from BC, Canada to get a firsthand look at the direction of quantum dot technology. As usual, we didn't get to see much of Stephen and Toshi as they had pretty much back-to-back meetings set up with existing partners and prospective clients for the entire time they were there but did get to spend some limited quality time with the rest of the QMC team, which we enjoyed very much!

We also want to make sure everyone saw the recent addition of quantum dot guru Dr. Nathan Stott to the QMC team where he has been brought on to be the Director of Materials. Dr. Stott's background is beyond impressive and in addition to playing a major part in the early development of quantum dots, he has deep connections with many of the key driving forces that will be shaping the future of the industry and we see Dr. Stott's decision to join the Company as another very strong endorsement of Quantum Materials Corp. and where they are headed in this industry. A summary of Dr. Stott's background is available in the recent press release at: http://www.otcmarkets.com/stock/QTMM/news/Renowned-Quantum-Dot-Innovator-Dr--Nathan-Stott-Joins-Quantum-Materials-Corp?id=122606&b=y

So, with such a major directional shift in support for quantum dots at this years' CES, where does that leave Quantum Materials Corp in their stated quest to become a major supplier in the QD materials revolution? Well, we think that sometimes to get a better view of a situation you have to take a few steps back from the brightness of the Klieg lights and look at the "big picture" fundamentals. So let's do that for a moment. From recent press releases we know that QMC has the ability to produce commercial quantities (present capacity of 2.25 metric tons/year with low capex to increase capacity as needed) of high performance spec, low line-width, high quantum yield cadmium-free (and cadmium based) quantum dots that have excellent stability when subjected to heat (up to 260 degrees C), moisture and oxygen exposure - and they have a current Joint Development Agreement signed with one of the world's largest suppliers and manufacturers of opto-electronic film products (Nitto Denko based in Japan) with a customer list that includes most, if not all of the largest and best positioned flat panel/handheld display manufacturers. Therefore we liken QMC's current position as a grand tour cyclist that has been letting some of the others in the peloton sit up at the front of the pack and do the early work to push the industry forward
while they pedaled along conservatively just behind the front runners and built out their production infrastructure, high performance product specs and industry relationships to propel themselves to the main chase group. Now that QD adoption is moving mainstream and this industry is moving closer to the finish line, we fully expect them to make their move into the mainstream with a low cost, high volume manufacturing method/global partners and capture their share of this burgeoning business. When you consider that at a range of $100 to $200/gram (not quoting the cost of quantum dots here, just using a number we have seen mentioned in the press for QD’s lately), at just 10% utilization of QMCs current capacity they would be looking at roughly $22.5 to $45 million in top line revenue. At full utilization that number would be . . . well, we’ll let you do the math on that one yourself.

CES 2016 removed all doubt that we are now past the tipping point for quantum dots in flat panel displays. Welcome to the REVOLUTION!!!

To learn more about Quantum Materials Corp. be sure to check out their website at http://www.qmcdots.com as well as a recent corporate video that highlights their proprietary, extensively patent protected continuous flow manufacturing method, their product development track and competitive advantages available at:
http://www.qmcdots.com/videos.php

Link to current PPT presentation: http://qmcdots.com/qmcdcemberpresentation.pdf

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