The Quantum Dot Revolution is Alive and Thriving in San Marcos, TX

July 28-29, 2015 - Quantum Materials Corp. Star Park Wet Lab and Corporate Headquarters Site Visit

Arriving in San Marcos - Local Temperature: 98 Degrees Fahrenheit

After a direct flight and short drive to San Marcos from the San Antonio airport, my QMC site visit got started by meeting with Quantum’s new CFO Craig Lindberg. Craig is one of those guys that you know you’re going to like the very first instant you meet them - smart, interesting, great sense of humor, accomplished and down to earth. Quantum Materials Founder and CEO Stephen Squires wanted a high caliber candidate to take on the financial management and reporting side of the Company (so that he could focus on the primary mission of getting
Quantum on a course to establish supplier contracts and driving in revenue) - and we are pleased to report that he has done just that with the addition of Craig, who brings a vast amount of public company financial management experience to the QMC team. After a brief meeting, we met up with QMC Founder/CEO Stephen Squires and Quantum’s VP of Asian Business Development Toshi Ando and over some excellent Texas grub, we discussed Quantum’s press release earlier that day in which they had announced a joint development agreement (JDA) with one of the major flat panel display manufacturers. The identity of this display manufacturer was not named in the release for a number of strategic reasons, and the team is keeping a tight lid on this information which we understand - but over dinner we were able to glean some details on what the primary goal and desired endpoints of this relationship are - namely to incorporate QMC’s proprietary, high performance, cadmium-free QDx™ quantum dots into engineered solutions that can be dropped directly into LCD/LED fab lines for powering high color gamut output in next generation quality displays. We also learned that one of the key benefits of the JDA relationship is that this structure allows the two groups to form a "virtual development team" working towards a common goal wherein both sides have real time access to information thereby cutting out time lost to feedback loops. Based on the enthusiasm of the team and the palpable excitement of being able to put this relationship on paper in the form of a formal agreement, the QMC team sees this development as a significant milestone marker in moving the Company forward and we are confident that Quantum will share more information with the market about this key new relationship as soon as it’s practicable to do so.

After dinner Stephen and Toshi needed to get back to the office for their standard round of calls since QMC’s work schedule get started around 9:00am CDT and the exec’s work thru the day with a dinner break - and then return to the office for several hours of calls with Asia based contacts in the late evening hours (9:30pm in San Marcos is
roughly 11:30am on the other side of the world, where most of the consumer electronics manufacturers are located).

The Star Park Site Visit - Quantum Materials Corp. Corporate Headquarters and Wet Lab Facility

QMC is located in Star Park, a TSU sponsored technology incubator facility, an ideal address for a company of QMC’s size and development stage. The Company recently moved into a new space at Star Park roughly 4X their old footprint - and as the Star Park campus is currently expanding in size QMC will be in a position to add space in the future as needed to expand their operations. In addition to this great "flex" capability, Star Park provides an excellent complement of common areas such as board rooms, dining area/kitchen, reception area, etc. which greatly reduces overhead for all and even allows for some collaboration on materials projects from time to time with other high tech neighbors.

To get our site visit started we met up with Quantum’s VP of Research and Development David Doderer who acted as our main tour guide. This is the first time we have had the pleasure of meeting David (we have had a number of calls with David to date) and once again we continue to be impressed with the QMC team that Stephen has assembled. David has been with QMC since the inception of the Company seven year ago and it shows. His knowledge of both the overall quantum dot market as well as QMC’s key value drivers and product differentiators is excellent, and try as we might, we were unable to ask a question that he was not able to answer in fine detail. After our introductory Q&A in the conference room, David led us into Star Park's main corridor for the first leg of our tour: the new wet lab space and Quantum's recently received and commissioned two metric ton-per-year capacity quantum dot machine.
QMC’s Continuous Flow Technology Platform - A Highly Efficient Core Differentiator

The one word that keeps coming to mind when touring QMC’s operation is efficiency. From efficiency in personnel, to efficiency in lab space to efficiency in operations, this is a well oiled machine. Even though they were still in the process of moving their small machine from the old wet lab into the much larger wet lab space (QMC’s new 2 metric ton/year machine was installed and spec’d out for production in the new wet lab space) there is no sign of waste here. In fact, QMC is a shining example of what we consider to be a "disruptive technology" – namely doing more with less - and at a lower overhead cost. In that regard QMC has nailed it. And when you consider that they have been able to set up a facility that has current capacity of 2.25 metric tons/year (2,250 kilograms) of quantum dot production, this group is currently one of, if not possibly the largest capacity manufacturers of cad-free quantum dots in the world. This efficiency in space and manufacturing capacity is a direct result of QMC’s “continuous flow chemistry” processing technology. The disruptive nature of this technology really comes to life when you see it in person. Scaling up the batch of quantum dots is merely a task of connecting the material intake tubes to larger containers of the various elemental building blocks/precursors that comprise the type of quantum dots that are being made at that time. After getting a quick tour of the new wet lab space and checking out the new two metric ton/year system, (note: as mentioned before, QMC is in the process of consolidating the current lab space and management offices into a much larger wet lab space) the tour moved back over to the current wet lab so that we could get a demonstration of the pilot scale plant in action and see some quantum dots being made in real time with continuous flow chemistry.

Inside QMC’s Quantum Dot “Foundry"

After getting a high-level description of the pilot plant's inner workings and the primary steps of how this complex device is able to make high specification, cadmium-free quantum dots (in both quantum yield and narrow line width, a performance spec referred to as FWHM or “Full Width at Half Maximum” which is a standard measurement used in the industry to define purity of light produced), we were asked if we would like to come back in about an hour or so and make a small batch of quantum dots. Naturally, we
thought that was a great idea so after a quick bite at nearby *San Marcos BBQ*, we proceeded directly to the wet lab for our "date" with the pilot scale machine. After donning an official white lab coat and blue gloves we moved up to the machine's control panel and awaited direction from QMC's scientific staff. The instructions were simple; flip a toggle switch down and move one of the dials to a specified setting (we were of course going to make a batch of green dots) and that was it. After a short wait, a light green liquid started to drip systematically into the collection tank. After a few milliliters of the quantum dot fluid built up one of the lab techs trained a UV light source on the vial and the mixture emitted a bright green light that looked very much like the neon green goo used in the 1984 cult classic Ghostbusters. We're talking very intense and very bright here -

Multicolored "Rainbow" of high performance Quantum Dots

pure color that literally "jumps" out of the collection vial and into your eyes. One of the key features of both machines is that they are equipped with a sophisticated laser system that monitors the output side of the system in real time measuring the performance specs of quantum yield (or brightness level) and FWHM on the fly to ensure each batch of quantum dots is exactly to spec. The system looks simple on the outside but you can tell by watching it in action that this is a very sophisticated and highly engineered system capable of performing what has traditionally been an extremely difficult, time and labor intensive process. It was after our quantum dot making session that we were able to learn a bit more about QMC's most recent development in product capabilities, namely the new product line of heat, moisture and oxygen stable QDX™ quantum dots (and yes, we were told that the "X" in QDX™ stands for *extreme*). Quantum's technical team has been hard at work in San Marcos and has called upon their extensive nano-material development experience to engineer the QDX™ proprietary line of quantum dots. QMC’s management team explained that this new line of more robust quantum dots has come about as a result of direct feedback from display manufacturers which have experienced material performance shortcomings with existing cadmium-free quantum dots presently available in the market. While designers have been able to partially “design around” these shortcomings, this situation has actually held back flat panel display
designers from optimizing all the benefits that can be brought to the market via the utilization of quantum dots. In fact, one of the key drivers which is now creating increased interest in QMC’s QDX™ dots is their stability and heat resistance to a threshold temperature of 260 degrees Celsius (equal to 500 degrees Fahrenheit). We learned during the site visit that this is a significant design threshold due to the fact that quantum dots are oftentimes subjected to high heat levels in both the processing to incorporate them into next generation displays as well as under general operating conditions - and it's our understanding that some of the cadmium free dots currently available on the market have been showing signs of quantum yield degradation as a result of exposure to these high heat environments. Additionally, QDX™ class quantum dots’ high performance stability when exposed to oxygen and moisture would allow display designers to potentially cut out or reduce costly barrier film components that have been added to present QD display designs to effectively "seal off" these nano-crystals from the outside world and prevent them from degrading in brightness over time - and as you likely know, driving down design cost is a key consideration when incorporating new technologies into the consumer electronics marketplace. One of the key takeaways from this site visit was just how excited the QMC team is on their new QDX™ line of quantum dots. It certainly appears that this recent development is going to be a key differentiator for QMC to advance their stated mission of building market share among flat panel display manufacturers looking to bump up the color gamut of next generation displays. Looking further ahead QDX™ also holds great promise in optimizing applications in solid state lighting, where it looks to be a real game changer. Based on this most recent development we look forward with great anticipation towards the Company's future in this rapidly evolving revolution in opto-electronics innovation.

Our time in San Marcos literally flew by and before we knew it, it was time to get back to the airport for our return flight. We had seen and learned a lot in a very short time frame, and want to take this opportunity to thank the entire Quantum Materials Team for taking us "behind the ropes" at their finely tuned Star Park facility.
Final Thoughts on the Quantum Materials Corp Site Visit

During the short drive to the airport, we had a chance to reflect on what we had just seen and couldn't help but think we had just witnessed something really special - possibly even one of the fundamental building blocks in an exciting new revolution of nano-materials science that will influence, change and disrupt any number of technologies both now and well into the future. When we first met QMC CEO and founder Stephen Squires just one short year ago we got a sense early on that this forward thinking materials entrepreneur was on to something really big with quantum dots. In that time everything he has been telling us was going to happen in this burgeoning industry has happened - maybe not as fast as it was expected to - but it has happened. After the benefit of spending a day with the creators of QDX™, we see this new technology as a major breakthrough within the larger breakthrough of quantum dot materials science. If that truly turns out to be the case, and at this time we have no reason to doubt that - we will have much more to share with you in the future as this early stage nano-materials group hits full stride and moves towards the forefront of this rapidly emerging quantum dot industry.

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