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Sustainable Innovation on the Road to Market:
Moving from the Lab to Global Impact for the Cement and Concrete Industries

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Abstract

The production of cement is responsible for 3-5% of total global carbon emissions, making it the world’s second largest emitter of carbon dioxide (CO₂). Solidia Technologies® is a cement and concrete technology company bringing sustainable innovations to a market that is thousands of years old and in search of a solution.

Solidia Cement™ is a low-lime alternative to ordinary Portland cement, and emits 30% less CO₂ during its production. Solidia Concrete™, made using Solidia Cement, consumes CO₂ in the curing process. Together, these novel technologies reduce the overall carbon footprint associated with the manufacture and use of cement by up to 70%. But we don’t lead with the sustainability profile; our primary focus is on the superior performance, the savings of time and costs, and the ease of adoption that our processes offer. To help sustainable innovation gain traction in the marketplace, we advocate changing the conversation, translating our solution as one that directly addresses the industry’s current challenges and fits into the way they operate today.

The road to market for innovative technologies is paved with risk and potholed with failure. To succeed, you must fail...fail quickly...and recover. It takes a village to shepherd innovation to market: a cast of players, from start-ups to industry giants, investors to academics, all acting out distinct roles based on their resources, market knowledge, technological prowess, and tolerance for risk. The role of the start-up is to learn and then use that understanding to reduce the industry’s exposure to risk by rapidly managing the innovation process.

As a first step, innovators must learn the market inside and out. Through research and partnership with industry players, innovators must gain firsthand knowledge about how the industry works. Then, by tailoring both the technological approach and commercial strategy to boost performance with minimal change and at the lowest cost, innovators can meet industry where it is today. Solidia Technologies collaborated with industry, government and academic partners to leverage the market’s existing equipment, raw materials and processes to make our sustainable technologies easy to adopt. A top priority of our R&D is developing products that offer superior performance over traditional Portland cement-based concrete products.

If the worldwide cement industry were to implement Solidia’s processes today, it would achieve the Cement Sustainability Initiative of the World Business Council for Sustainable Development’s 2050 goals in a matter of years. Solidia Technologies’ story is a clear example of how to successfully introduce a sustainable technology into the global concrete market: first make it good business, then make it green.
Introduction

Every great success story starts with a story of failure.

Concrete is the most widely consumed man-made material in the world. The production of cement is responsible for 3-5% of total global carbon emissions—the world’s second largest emitter of carbon dioxide (CO$_2$). A modern cement plant will release about 810 kg of CO$_2$ per tonne$^1$ of cement clinker produced.

In an effort to address the large CO$_2$ emissions from the cement industry, the International Energy Agency (IEA) created a roadmap to guide the industry’s long-term sustainability efforts. To achieve the IEA goals, the cement industry must reduce its total CO$_2$ emissions from 2.0 Gt in 2007 to 1.55 Gt by 2050. Over this same period, however, cement production is projected to grow from 2.6 Gt to 4.4 Gt.$^{2,3}$

The industry knows this is an issue they must address, and they have set goals to dramatically reduce their carbon footprint. The Cement Sustainability Initiative of the World Business Council for Sustainable Development set 2050 CO$_2$ reduction targets for the global cement industry. For them, it is a matter of survival.

To address this formidable challenge, the cement and concrete industries have adopted both evolutionary and revolutionary strategies. The evolutionary strategies include the implementation of energy-efficient production technologies, the use of alternative fuels, the development of new cement chemistries with low-lime content, and the reduction of the clinker factor in cement. The reduction in clinker factor is achieved by co-grinding cement clinker with supplementary cementitious materials, such as fly ash, slag, natural pozzolanic materials, and fillers, such as limestone. However, even the combined effect of these initiatives is likely to fall far short of the IEA roadmap goals. This roadmap even anticipates revolutionary approaches, including broad implementation of carbon capture and storage technologies that are expensive and, in fact, not yet proven at commercial scale. The industry is left trying to face these challenges with a large and aging infrastructure, complex chemistry, and a conservative market not adept at adapting new technologies.

Attracting investors for new, green technologies is a challenge. Persuading industries to change time-proven practices and products is even harder. Trying to do both as a start-up can be daunting. Leading this change based purely on sustainability will not suffice.

The only way to rapidly introduce a sustainable technology into the cement and concrete markets is to first make it good business, then make it green. To truly bring innovation to the forefront of any industry, especially one resistant to change, the company must demonstrate broad applications and practical, proven benefits of the new technology within it. First fit in, ushering in change with profitability, simplicity and familiarity. Identify the industry’s pain point, but don’t pile on.

$^1$ All calculations are based on the tonne, also known as the metric ton, equaling 1,000 kilograms.


Overcoming Obstacles to Disruptive Innovation

The quickest way to introduce change into a market with longstanding traditions is to work especially hard at making it simple. Simple is hard, really hard. Such a change demands a solution that minimizes cost, maximizes impact and adds value.

Here’s our story. Solidia Technologies is a cement and concrete technology company bringing a sustainable innovation to a market that is thousands of years old. The last time this industry embraced a major product innovation was about 200 years ago with the invention of Portland cement. Solidia Technologies created a real solution that was inspired directly by the industry’s CO₂ challenge.

Making it Simple is Hard.

Solidia doesn’t only develop sustainable technologies; we make it possible for industry to adopt them. To drive innovation to market, you need the right people, a compelling vision, collaborators who give you market insight and credibility, and not quite enough time. R&D needs to be quickly focused and directed by market insights and hard data, not theories. To remain competitive, the business itself must be sustainable within the context of the marketplace.

As a leadership team that had worked with disruptive innovation from a variety of angles, we were able to combine our unique perspectives to put Solidia on a more realistic path. Our professional experience includes vantage points critical to commercializing innovation, including that of: the giant global leader (leading global businesses for DuPont in building materials); the technology incubator (directing the Office of Commercial Ventures and Intellectual Property at University of Massachusetts Amherst); and a variety of research and business management roles at Fortune 1000 technology companies in the US and abroad. Joining forces now at a start-up, we shared an appreciation for operating with a deep understanding of the market and set out immediately to place our team in the shoes and mindset of our target industry.

We offer Solidia’s roadmap to market and all we’ve learned as a case history on sustainable innovation. On getting it wrong, until you get it right.

Understand Your Market.

Targeting the estimated US$1 trillion concrete and US$300 billion cement markets, Solidia overcame two of the biggest obstacles to disruptive innovation: ease of implementation and cost of adoption. The technology addressed an urgent, global business and societal need while profitably supporting an industry seeking to improve production methods.

As innovators, to advance sustainability and attract investors, you must first demonstrate that you can sustain yourselves. Above all, the start-up has to prove the technology is commercially viable. First, the innovator must focus on targeting the largest market possible, demonstrating broad applications within the market. To succeed, you have to take the time to understand the industry…intimately and thoroughly.
Our headquarters was full of largely academically trained scientists and engineers who had never spoken to a potential customer in our target market. We had a supportive board; a CTO with vast experience translating technology to markets; an R&D director who knew the science inside and out; and a young team of engineers who really didn’t like to be told they couldn’t do something. All we had to do was point them in the right direction.

Therefore, the first thing we did as a team at Solidia was move the entire company out of the office for two months to have them go into the industry and learn, with the instruction: “Don’t teach. Just listen.”

What they learned completely changed the company’s direction from both a research and a market perspective.

The team’s conclusion was simple: “We have the wrong cement, the wrong curing process and the wrong equipment….but we know exactly what to do!”

Our preliminary technology worked, but we miscalculated the barriers for adoption from a lack of industry knowledge. It wasn’t a total failure, per se, but it would have led us to certain failure in the long run. A great indicator of whether R&D organizations are heading down the right track is seeing how they work to bridge the gap between where the target industry is today and where they need it to be to adopt the new technology. Along the way, we discovered through trial and error, as well as supportive guidance from partners, investors, and industry players, that the only way to close that gap is to build the bridge one small section at a time.

**The Solidia Solution: Getting to the Right Cement**

First we had to develop the right cement. By studying the industry closely, we learned that the right cement is made from raw materials that are available everywhere.

Our technology intended to use naturally occurring minerals—wollastonite in particular—as our cement. Our initial narrow view focused on sustainability and the carbon footprint, but it didn’t take into account that the product was available only in certain geographies and unavailable in quantities large enough to satisfy this giant market. We had to develop a new cement.

In addition, we spent quite a bit of time trying to understand why other green cements had failed. The answer became very clear, very quickly. Sharing four common characteristics (each had at least one, and most had elements of all), they:

- relied on raw materials that were not ubiquitous.
- relied on investment in expensive new manufacturing equipment.
- produced a concrete that could not meet the physical performance required by the industry.
- tried to bypass industry convention and tried to enter the market on their own terms.

We were faced with developing a new cement that carbonated and could overcome all of these issues. We decided that the cement had to be made on existing kilns using existing raw
materials. No one would invest in an unproven technology, nor would they import new raw materials to their plants that were sited based on raw material availability. Any other solution would be too expensive.

The chemistry needed was apparent. Next we had to find someone willing to make it for us. Our new cement had been successfully made in our own lab kiln, but we needed to demonstrate that it could also be made on a rotary kiln. Most of the research kilns had been decommissioned decades ago, but fortunately we found a lab in Europe that had several we could rent.

We had a few engineers that had run kilns, a group of materials scientists that understood the chemistry, and the money to afford the trials. We selected raw materials that we thought were representative of what you might find at a typical kiln (later learning there are no ‘typical’ raw materials). Our two-week trial was successful. At this point, we had cement that we could use in trials to prove to potential cement partners and concrete customers that it could be done.

From a technical perspective, we developed Solidia Cement™: a non-hydraulic cement composed primarily of low-lime, calcium silicate phases such as wollastonite / pseudowollastonite (CaO·SiO$_2$). This contrasts with the high-lime phases that comprise ordinary Portland cement (OPC). The setting and hardening characteristics of Solidia Cement are derived from a reaction between CO$_2$ and the calcium silicates.

Now we had the chemistry, but who was going to make it?

**Leaning On the Experts**

Going it alone will get you lost, especially if you're doing it without a map. Large and small industry players have a symbiotic relationship: start-ups often manage risk better than large industry players, while established sector leaders provide real-world, practical market intelligence, R&D support and access.

We needed a partner. But what kind? There were two choices: assemble a network of toll manufacturers that could supply the world, or pick a single partner who was interested in helping us get started and willing to teach others.

The first option wasn’t viable. If our new cement was going to be successful, we would have to put in a team of kiln experts to start up new kilns and then define the logistics to move the cement around the world. It was just too complex. We would also have to lead the charge through the code process. Doing that without a partner was impossible.

What kind of partner did we need? Our perfect partner needed a few key characteristics:

- a true commitment to sustainability—not just lip service for their annual report;
- a global footprint (at least in our target geographies);
- a proven track record of research, not just process improvement; and,
- a willingness to work with a start-up.

Beyond that primary relationship with an established industry player with a large global presence, it was clear that we also needed an array of other partners from the public and private
sectors and academia who could lend credibility and help shift the discovery from theory to application. Innovators are wise to cultivate third-party, collaborative efforts in applied research, materials testing and characterization, manufacturing logistics and general marketing. (See more on these other R&D partners below.)

Based on our criteria, we chose LafargeHolcim (at the time known as Lafarge, S. A., pre-merger). Fortunately, they also chose us. A world leader in building materials and on research in concrete applications, LafargeHolcim researchers and technical experts worked with Solidia Technologies to demonstrate the feasibility of commercial-scale production in a conventional cement plant. In April 2014, a joint LafargeHolcim and Solidia team validated the reduced carbon footprint and commercial viability of Solidia Cement during a full-scale trial at LafargeHolcim’s Whitehall cement plant in the US. Next, we repeated the trials in Europe so that we had a supply plant in each region for early adopters.

Beyond R&D, our industry partners play a vital role helping us enter the market. Central to our commercialization strategy is lining up all the partners and support a customer will need to facilitate adoption.

Next….focus on the concrete and determine the best path to market.

**CO₂ Curing: Making a Complex Technology Simple**

Ordinary Portland cement uses water to cure and releases about 800kg of CO₂ for each ton produced. The hydration process involves the hydration reaction between high-lime calcium silicate phases and water to form calcium-silicate-hydrate gel and calcium hydroxide.

It also takes 28 days to reach maximum strength. By contrast, to create Solidia Concrete™ products, water, aggregates and Solidia Cement are mixed, formed into the desired shape and then reacted with gaseous CO₂ to produce a durable binding matrix. During the carbonation process, calcite (CaCO₃) and silica (SiO₂) form and are responsible for the strength development in concrete. In other words, during the curing process, CO₂—from waste flue gas—reacts with Solidia Cement to form calcium carbonate. It is permanently transformed from a gas to a solid that resembles natural limestone. The gas could only be released if it were put into a high temperature kiln. The curing process sequesters up to 300 kg of CO₂ per tonne of cement used and happens very quickly—certainly less than 28 days. We thought that was enough; we were wrong.

The Process was Wrong.

When we started working together on the leadership team, we were targeting the exterior cladding market using the following approaches:

1. an autoclave, containing a CO₂-rich atmosphere;
2. pressurized to 20 psig;
3. heated 90°C; and,
4. maintained for a 72-hour curing cycle.
Through our industry research, we discovered these approaches were all problematic for the industry (see below). And despite our best efforts, the process wasn’t uniform, and our results were even more unpredictable. To get to this point, we had simply extended the original experimental process developed in the Material Sciences Department of Rutgers University, where the first generation of the technology was invented. Using pressure and temperature was a time-worn strategy to drive CO₂ into cement. People had been doing it for decades with Portland cement. But it was wrong.

At the end of our first week as the CEO/CTO team, we pulled our full leadership team into a room in order to fully understand what the core of our technology was and how we might leverage that to build the business. By the end of the day, the team decided that our current strategy was based on our technical knowledge, not what the market really wanted or needed. It was at this point that we decided to do something radical, as noted above: we stopped all work on our current process, paired technical team members with business team members, and sent them into the market to learn.

We talked to everyone—cement companies, precasters, government officials, architects, and more—anyone that could help us understand how the market worked. There was only one rule: “You can ask questions, but you can’t teach, sell, defend or do anything that would keep our discussion partner from opening up.”

When the team returned, they had completely changed the R&D strategy. In summary, they identified the following problems within our current approach:

1. **Using the autoclave**: Very few concrete manufacturers used autoclaves, primarily because of their high capital and operating costs. We had to find a simpler, less expensive curing chamber.

2. **72-hour curing cycle**: While the complete curing of concrete takes up to 28 days, most precast concrete manufacturers wanted to load and unload their curing chambers within a 24-hour production cycle (the balance of the 28-day cure cycle occurs outdoors). We had to load, unload and cure in less than 24 hours.

3. **Curing at 90°C**: While 90°C may be the ideal temperature for wollastonite to cure, it was not ideal from an equipment design perspective. Any temperature above 60°C would require specialized hardware that was too expensive. We had to cure Solidia Concrete at a temperature of 60°C or less.

4. **Pressurized curing** (See problem #1!): We knew what our target was. We had spent five years working on a different technical strategy, and now we were going to change everything. How do you completely redirect an organization to chase a different dream, one that they didn’t know how to do?

Our leadership team drew a very distinct line: curing at atmospheric pressure, at less than 60°C, in less than 24 hours. No flexibility. Anything outside of those parameters represented failure. If we blinked, the company failed.
Fast forward two months: they did it. Our amazing cohort of scientist and engineers—running the gamut from young to experienced, believers to doubters—met the boundaries that we had established. In doing so, they opened up a completely new patent estate that has defined the company ever since. Give a group of really smart people the resources to do the work and the confidence to succeed, and you get miracles.

Next, we turned to equipment experts to help us design equipment that would allow the CO₂ curing process to take place with minimal plant conversion. CDS Group, the world’s leading curing and drying specialists, is collaborating with us on the design and manufacture of curing chambers to accommodate the CO₂-curing process.

**Superior Performance: The Same, Plus…**

Solidia Concrete contains the same raw materials as those used in concrete products made with ordinary Portland cement, namely, fine and coarse aggregate, supplementary cementitious materials, and chemical admixtures. In addition, the manufacturing of Solidia Concrete products is performed using identical mixing and forming processes as those adopted in OPC-based concrete production.

Solidia Concrete can be produced by manufacturers of traditional concretes and designed to address virtually any precast concrete application, and adapted to any concrete formulation, production method and product specification. It outperforms traditional concretes in a range of properties including strength, abrasion resistance and durability. Additionally, the curing of Solidia Concrete can be completed in a matter of hours, allowing for rapid deployment. It is the same, plus.

Our initial technology focus was on unreinforced precast applications, including pavers and blocks. Solidia is now developing commercial processes for reinforced applications, including aerated concrete, railroad ties, architectural panels and hollow core extrusions. Our IP portfolio comprises four US patents and more than 100 patent applications worldwide.

The product strength and durability has been tested and verified according to all market standards: ASTM and AASHTO specification by the CTLGroup, formerly the R&D laboratory of the Portland Cement Association, as well as EN and CSA.

**It Takes a Village to Get to Market**

Don’t take our word for it, and certainly never ask customers to do so. Collaboration is key. As noted above, established industry leaders have proffered a wealth of experience, knowledge and reality checks, and have opened doors to potential customers for collaboration and sales.

We sought out eminent authorities respected by the industry who to this day put our innovation through the mill of rigorous testing and analysis. Our R&D is bolstered by the expertise of leading academics at research universities and scientists at national laboratories on the properties of cement and concrete.
Ongoing testing continues in laboratories at Rutgers University, where the original generation of the technology was co-invented by Professor Richard Riman, Ph.D., and Vahit Atakan, Ph.D., who is now Solidia’s Chief Scientist. At Purdue University, a team led by Professors Jan Olek, Ph.D., and Jason Weiss, Ph.D., who recently moved to Oregon State University where he continues to test Solidia products, report Solidia Concrete’s outstanding performance in freeze-thaw, freeze-thaw with deicing salts and sulfate environments.\(^4\)

At Ohio University’s Institute for Corrosion and Multiphase Technology (ICMT), Professors Yoon-Seok Choi, Ph.D., and Srdjan Nesic, Ph.D., are leading a group of scientists examining methods to better passivate the surface of steel rebar. Professor Alberto A. Sagüés, Ph.D., heads a Civil and Environmental Engineering team at the University of South Florida that is aimed at characterizing the corrosion of steel rebar embedded in Solidia Concrete in a variety of service environments. Partnering with academia not only lends credibility through peer review, but also allows new, fresh minds to collaborate on creating a solution.

Public entities offer many programs in support of sustainable technology with targeted needs, from infrastructure to building to reducing air pollution. They offer funding, laboratories, expertise, and conferences where innovators share war stories.

The National Energy Technology Laboratory of the US Department of Energy co-funded a four-year research and development project as part of its CO\(_2\) Storage Program. That research has focused in part on improving the understanding of water distribution in Solidia Concrete during the drying and CO\(_2\)-curing process. The research demonstrated that Solidia Concrete can achieve full hardness in a time comparable to that of Portland cement-based concrete in a controlled curing environment.

Results of research conducted under Phase I of the Small Business Innovation Research (SBIR) Program of the US Environmental Protection Agency confirmed that the incorporation of supplementary cementitious materials can further reduce the carbon footprint associated with the production and use of Solidia Cement. This research demonstrated that waste materials such as ground fly ash and blast furnace slag can be used to replace Solidia Cement by as much as 40% in concrete formulations.

The Federal Highway Administration of the US Department of Transportation supports Solidia with a multi-year Cooperative Agreement to examine transportation infrastructure applications. This joint program includes independent testing of Solidia Concrete at the Turner-Fairbank Highway Research Center.

We have also attracted investors, including Bill Joy, Kleiner Perkins Caufield & Byers (KPCB), Bright Capital, BASF, BP, LaFargeHolcim and Total Energy Ventures, who have elevated sustainability to a core purpose and value social impact as well as profits. Many of our investors offer industry expertise, opportunities for visibility, entrée to other investors, and helpful guidance on bringing innovation to market and building a start-up.

Oh, and It’s Sustainable…

And, the coup de grace: the reduced CO₂ emissions associated with the production of Solidia Cement and the CO₂ sequestration associated with the curing of Solidia Concrete combine to reduce the carbon footprint of cement and concrete by up to 70%.

Solidia Cement is more sustainable than ordinary Portland cement. The clinker of Solidia Cement is produced at a temperature of about 1200°C, which is roughly 250°C lower than the sintering temperature used in Portland cement clinker manufacturing. Production of Solidia Cement reduces the emission of greenhouse gas CO₂ by 30%.

Solidia Concrete⁵ consumes CO₂ in the curing process. It sequesters up to 300 kg of CO₂ per tonne⁶ of cement used.

As water is not consumed during the Solidia Concrete curing process, it can be collected and reused, with recycle rates in excess of 60%, and potentially as high as 100%.

Hypothetically, if the worldwide cement industry were to adopt Solidia’s technologies today, it would achieve the WBSCD 2050 goals in a matter of years. Remaining competitive as the industry pivots to a carbon economy will quickly become a much higher priority.

Running businesses has taught us that, if you want to remain competitive, you have to become more sustainable. That said, the fact that Solidia Cement and Solidia Concrete have a vastly superior sustainability profile than anything available in the market today is icing on the cake. More important is that we’re making it easy for one of the world’s largest industries to go green.

Conclusion: Changing the Conversation

Great technology is not a story about science; it’s about the people with the passion, courage humility and staying power required to shepherd it to market.

At Solidia, we have taken a complex technology and made it simple and applicable anywhere in the world. Combined with an innate sense of urgency, our team quickly translates market insight from our industry and other R&D partners with leading-edge technology to produce a credible solution to a problem long sought by the industry. This collaborative approach, along with a focused effort to target individual markets that need a better solution, results in an unusually rapid acceptance by an industry that values performance. The fact that it is sustainable is readily embraced, but it has to work first. It can’t just be green; it has to be better.

To open minds to innovation, we need to approach industry first and foremost as a solution to companies looking to survive: namely, how to maintain or boost profitability, how to grow market

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⁵ Solidia Concrete and Solidia Cement are interdependent materials; Solidia Concrete can only be made with Solidia Cement. All calculations herein are based on trials using Solidia’s patented processes. See Solidia Cement™, December 2013 and Solidia Concrete™, February 2014.

⁶ All calculations are based on the tonne, also known as the metric ton, equaling 1,000 kilograms.

⁷ Water Savings In Concrete Made From Solidia Cement™, April 2014.
share, and, for cement manufacturers, how to survive as the world pivots to the carbon economy. Sustainability cannot lead the conversation; the industry experienced severe setbacks in the past by adopting green cements that were not adequately tested for long-term strength and durability.

Solidia Technologies came up with a vision that informed its business strategy: We are a cement and concrete technology company with a goal of making it easy to adopt sustainable technologies by leveraging the market’s existing equipment, raw materials and processes. It has to be profitable from the beginning. And, oh, by the way, it’s also green.

Our vision has always been a world where CO₂ means green and sustainability is an engine for profitability and growth. For over 50 years, scientists have tried to cure concrete with CO₂ knowing the resulting product would be stronger and more durable; Solidia Concrete is the first to become commercially viable. By discovering and successfully commercializing an industrial application for carbon, one of the world’s most noxious pollutants, we hope to inspire others to explore problems for solutions.

Thomas (Tom) Schuler, President and CEO, Solidia Technologies, Inc. With more than 25 years of global leadership experience, including leading two global businesses at DuPont, Tom joined Solidia Technologies in 2011 to lead the company towards global commercialization. He is a frequent guest speaker before international trade and sustainable growth groups in the Americas, Europe and Asia. In 2014, he addressed the CleanTech 100 Summit at the National Press Club in Washington, DC when Solidia was named to the Global Cleantech 100. He was also a panelist at the 2013 Aspen Institute Ideas Festival, the 2014 TomTom Festival at the University of Virginia, the 2013 Cement Sustainability Institute Forum, and the 2013 European Energy Venture Fair. He has appeared on the Bloomberg News program "Money Moves" with Deirdre Bolton and was recently published in Sustainable Business Magazine. He has a Mechanical Engineering degree from the University of Virginia, extensive graduate study in Finance and Marketing, and a mastery of conversational German and French. He serves on UVA’s Jefferson Scholarship Foundation’s Alumni Advisory Council and national selection committee.

Nicholas (Nick) DeCristofaro, Ph.D., Chief Technical Officer, Solidia Technologies, Inc. Nick spearheads both the research and development program and the company’s intellectual property strategy. He has extensive experience managing materials science innovation in an industrial context. Throughout his career, Nick has focused on the development and commercialization of advanced materials. He came to Solidia Technologies from the University of Massachusetts Amherst, where he directed the Office of Commercial Ventures and Intellectual Property. Prior to joining UMass, Nick held a variety of research and business management roles over a 28 year period, cumulatively, at AlliedSignal, Honeywell International, and Hitachi Metals in the US and abroad. He has 66 patents and 30 publications to his credit. Nick earned Bachelor’s and Master’s degrees in metallurgy and a doctorate in materials science and engineering, all from the Massachusetts Institute of Technology.

Solidia Technologies® is a cement and concrete technology company that makes it easy and profitable to use CO₂ to create superior and sustainable building and construction materials. Solidia’s patented processes start with a sustainable cement, cure concrete with CO₂ instead of water, reduce the carbon footprint associated with cement and concrete up to 70%, and recycle 60 to 100% of the water used in production. Using the same raw materials and existing equipment as traditional concretes, the resulting CO₂-cured concrete products are higher performing, cost less to produce, and cure in less than 24 hours. Based in Piscataway, N.J. (USA), Solidia’s investors include Kleiner Perkins Caufield & Byers, Bright Capital, BASF, BP, LafargeHolcim, Total Energy Ventures, Bill Joy and other private investors. Honors include: 2016 Sustainia 100; 2015 NJBiz Business of the Year; 2014 Global Cleantech 100; 2013 R&D Top 100; 2014 Best Place to Work in NJ; 2014 CCEMC Grand Challenge First Round finalist; 2013 Katerva Award finalist; and MIT’s Climate CoLab shortlist. Follow Solidia at www.solidiatech.com and on LinkedIn, YouTube and Twitter: @SolidiaCO2.