



# STARTUPS ENJOYING SUSTAINABLE GROWTH

Northwestern Engineering alumni entrepreneurs are changing the way the world builds batteries, transports gases, ships produce, and manages natural resources by bringing to market innovative green technologies that took root in the University's research labs and classrooms. *Northwestern Engineering* reached out to the leaders of four sustainability-focused, alumni-founded startups to learn about their latest successes and future plans.



## Hazel Technologies Founded: 2015

### THE ALUMNI

**Patrick Flynn** (computer engineering '15), chief marketing officer

**Amy Garber** (MS Law '15, Kellogg Executive Certificate '15), chief intellectual property officer

**Aidan Mouat** (PhD chemistry '16), co-founder and chief executive officer

**Adam Preslar** (PhD chemistry '15, Kellogg Management Certificate for Scientists and Engineers '15), co-founder and chief operating officer

**THE BUSINESS** Hazel Technologies' biodegradable produce carton inserts, FruitBrite™ and BerryBrite™, use smart biotechnology to maintain freshness and extend the shelf life of fruits and vegetables.

**THE START** Hazel Technologies grew out of NUvention: Energy, a course offered by the Farley Center for Entrepreneurship and Innovation in which interdisciplinary student teams work to launch startups in the sustainable energy and clean technology space. During the course, the team spoke with food distributors and retailers to learn what happens when produce spoils. Motivated to develop an environmentally friendly solution, the team created a prototype for FruitBrite—a small pod placed in shipping containers that releases natural biomaterials into the air to inhibit ethylene, a hormone in fruits and vegetables that spurs ripening. The team found that its solution helped keep produce fresh up to three weeks longer than other current technologies.

**PREVIOUSLY** After initial product testing in early 2016, the team earned a \$100,000 Phase 1 Small Business Innovation Research (SBIR) grant from the United States Department of Agriculture and the \$500,000 top prize from the Clean Energy Trust at its 2016 Clean Energy Challenge.

**THE LATEST** In June 2017, Hazel Technologies announced a partnership with Dresick Farms, the ninth largest fruit grower by acreage in California, to include FruitBrite in all of its honeydew, cantaloupe, and mixed melon containers exported to Asia. With an expanding customer base that includes produce growers in Florida, Washington, and California and anticipating an even more robust 2018, the team plans to add new staff, launch new test trials, and scale production in the coming months.



## SiNode Systems Founded: 2012

### THE ALUMNI

**Cary Hayner** (PhD chemical and biological engineering '17), co-founder and chief technology officer

**Joshua Lau** (materials science and engineering '12), co-founder and vice president for product development

**Samir Mayekar** (BA '06, KSM MBA '13), co-founder and chief executive officer

**Nishit Mehta** (KSM MBA '13), co-founder and former vice president of business development

**Thomas Yu** (materials science and engineering '11, graduate student in materials science and engineering), co-founder

**Guy Peterson** (MBA, MEM '13), co-founder and former vice president of business development

**THE BUSINESS** Using its proprietary silicon-graphene composites, SiNode Systems is building a longer-lasting, faster-charging alternative to traditional lithium-ion batteries, which have plateaued in effectiveness while consumer demand for on-the-go electronics continues to grow.

**THE START** SiNode Systems spun out of the Farley Center's NUvention: Energy course in 2011 after the team acquired the licensing rights to advancements in next-generation lithium-ion batteries made in the labs of Harold Kung, Walter P. Murphy Professor of Chemical and Biological Engineering, and Jiaying Haung, professor of materials science and engineering. The professors had developed battery anodes made of silicon nanoparticles and graphene that produced higher cell-level density to house more power than standard silicon-based anodes. Their unique design also allowed lithium ions to enter more quickly through tiny holes in the anode, shortening a battery's charging time.

**PREVIOUSLY** In 2013, the team was chosen to ring the NASDAQ closing bell in recognition of winning the Rice Business Plan Competition. In 2016, Hayner was named to *Forbes* "30 Under 30: Energy" for helping lead the startup's efforts to build better batteries.

**THE LATEST** A recipient of the 2017 Sustainable Practice Impact Award from VentureWell, the SiNode Systems team is developing advanced battery materials for target markets, including the company's first product for the consumer device space. In addition, the company won a \$4 million contract from the United States Advanced Battery Consortium to develop advanced anode materials for automotive lithium-ion battery applications, which could help accelerate growth in the electric vehicle industry.



## THE TEAM

**Omar Farha** (research professor of chemistry), co-founder and chief science officer

**Ben Hernandez** (industrial engineering '06, JD-MBA '13), co-founder and chief executive officer

**Chris Wilmer** (PhD chemical and biological engineering '13), co-founder and advisory board member

# NuMat Technologies Founded: 2013

**THE BUSINESS** Innovating at the intersection of big data, predictive analytics, and chemistry, NuMat Technologies designs and builds atomically engineered systems that harvest, store, and deliver high-value resources. The startup is the first to commercialize a new class of nanomaterials called metal-organic frameworks (MOFs), which are programmed at the atomic level to interact with gases, chemicals, and liquids. NuMat's fully engineered products that integrate MOFs are disrupting the \$500 billion gas industry by removing the need to highly compress gases.

**THE START** As a PhD candidate in the lab of Professor Randall Q. Snurr, Wilmer developed proprietary software algorithms that could design and predict the performance of MOFs. After collaborating with Farha to synthesize and validate the ultra-high performing nanomaterials in the lab, the two met Hernandez, then a JD-MBA graduate student interested in starting a business based on Northwestern

innovations. The trio forged a bond and soon began what would become NuMat.

**PREVIOUSLY** NuMat received \$300,000 and the Emerging Growth Award at the Clean Energy Trust's 2015 Clean Energy Challenge.

**THE LATEST** NuMat has strengthened its core computational and synthetic capabilities while forward integrating to fully design and build engineered hardware systems enabled by MOFs. In addition to being named one of "10 Startups to Watch" in 2016 by *Chemical & Engineering News*, the company announced a global partnership with The Linde Group, the world's largest industrial gas company, to develop next-generation separation and storage technologies using NuMat's foundational technology. In July 2017, the company established a commercial alliance with Versum Materials to distribute and sell ION-X, a compressionless gas storage system that safely stores and delivers electronic gases for semiconductor manufacturers.



## THE ALUMNI

**Alex Grant** (MS chemical engineering '17), co-founder and director of engineering

**David Snyder** (PhD materials science and engineering '16), co-founder and chief executive officer

# Lilac Solutions Founded: 2016

**THE BUSINESS** Lithium is in high demand as an essential material for high-energy batteries used in portable electronics and electric vehicles. Conventional lithium mining processes require large evaporation ponds and long processing times to extract the material from salt brines. Even then, only approximately 40 percent of the available lithium is recoverable. Lilac Solutions' ion exchange technology uses unique materials to selectively absorb lithium from a brine and then release it at high concentrations, increasing the accessible supply of lithium and mitigating the environmental impact of its production.

**THE START** As a PhD student, Snyder partnered with colleagues in Professor Christopher Wolverton's research group to search for new materials that could improve current lithium extraction processes. Using Wolverton's existing Open Quantum Materials Database, Snyder identified 13 potential new materials for ion exchange that could extract lithium faster at a

higher concentration and with a smaller carbon footprint.

**PREVIOUSLY** Lilac Solutions won \$15,000 in the Green Energy + Sustainability track at the 2016 Northwestern Venture Challenge. The team also earned a Phase 1 Small Business Innovation Research (SBIR) grant from the US Department of Energy to expand the company's portfolio of ion exchange materials for lithium extraction.

**THE LATEST** Lilac Solutions is working with developers of North American brine projects to access a vast new source of lithium. In June 2017, the startup completed a demo-scale manufacturing process with its unique ion exchange beads, which generated new angel investments. The team believes that the company's recent success will stimulate increased interest from investors in the battery and natural resource industries, as well as the acquisition of new customers and pilot projects.