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On the cover:
Photos taken at ACCGE-18 in Monterey, CA.
Photos courtesy of: Merry Koschan, Peter Rudolph, Candace Lynch

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It has been a very exciting year in the field of crystal growth, and a lot has happened since our last newsletter (Spring 2011).

Perhaps the biggest news in the last year has been the expansion of the single crystal sapphire market, driven by the demand for substrates for GaN-based LED’s for the rapidly-growing solid-state lighting market. According to Yole Development, the sapphire substrate market grew from $100M in 2005 to $220M in 2010 and is projected to reach $425M by 2020. In terms of wafer area, the sapphire market is growing at a rate of approximately 10 million square inches (MSI) per year from nearly 30 MSI in 2009 to > 60 MSI by the end of 2012. A shortage of wafers in 2010 drove the price of finished 2” wafers from $10 to $30 per wafer, triggering the entry of more than 50 new companies into the industry. A lower than expected LED TV market combined with increased capacity from the established vendors has brought 2” wafer prices back to their pre-shortage levels. Forecasts indicate that the demand for 2” substrates will shrink at a rate of ~10%/year from 60% of the total market in 2011, gradually replaced by 4” (~45% of the market by 2015) and ultimately 6” wafers (70% of the market by 2020). Two of the major US sapphire wafer suppliers are Rubicon and Saint Gobain, and three US companies are producing a large number of sapphire crystal growth systems: Arc-Energy and GT International in New Hampshire, and Thermal Technology in Santa Rosa.

The Solar Industry has also been a hot area for crystal growth (despite the frequent reports of solar manufacturers going out of business), growing at a rate of ~ 60% per year since 2007 based on worldwide solar module installations measured in giga-watts. The solar cell market is still dominated by Si (80%). Poly-Si has fallen off in market share due to its poor efficiency, and the emphasis instead has shifted to multi-Si (still not monocrystalline, but just a few large grains). Because of the rise in the PV market even and traditional Czochralski silicon growers like MEMC are investing in efforts like continuous pulling with melt replenishment to decrease costs in order to be competitive.

Radiation detectors have also emerged as a major market for bulk crystal growth over the last five years, driven largely by an influx of research and development funding from the Department of Homeland Security. Dr. Alan Janos from the Domestic Nuclear Detection Office (DNDO) gave an excellent plenary lecture on this topic at the 18th American Conference on Crystal Growth and Epitaxy (ACCGE-18) in Monterey. He described the latest results of efforts focused on the development of both semiconductors and scintillators for neutron and gamma-ray detection. The Transformational & Applied Research Directorate at DNDO is spending on the order of $25M per year to advance this technology, a large fraction of which is invested in bulk crystal growth.

The American Association of Crystal Growth has also had a very exciting and productive year. At the start of 2012
we relocated our headquarters from Somerville, New Jersey to Littleton, Colorado and our new administrator – Shoshana Nash – has taken over the day to day logistics and is doing a great job getting the AACG back on track. She distinguished herself at her first conference, ACCGE-18 in Monterey, CA, which was a great success (kudos to the Conference Chair Edith-Bourret-Courchesne and the Program Chairs Peter Schunemann and Peter Vekilov). Shoshana is taking a very active role to improve the organization, including work on a more user-friendly registration interface for future conferences, and enhancing the format and functionality of the AACG website (http://www.crystalgrowth.org/).

In July we held elections for the Executive committee and in October for the officers of the AACG – the results are listed in this issue. Historically we’ve tried to hold officer elections before the national conference so that we can recognize our outgoing president and officers for their efforts and introduce the new ones in person at the conference banquet. This year we were unable to do so, so let me take this opportunity to express my thanks to our outgoing AACG President Jeff Derby and Vice President Marek Skowronski for three years of excellent leadership. As the new president I am very grateful for the experience and dedication of Bob Biefeld (the new Vice President, who answers every email promptly and always has good advice) as well as Dave Vanderwater and Joan Redwing, both of whom will stay on for another term in the vital roles of Treasurer and Secretary respectively. Our first executive committee meeting with the newly elected committee and officers was held at the Fall MRS Meeting in Boston and was very productive.

Perhaps the most important item of business to our membership was the nearly unanimous vote (only one dissenting vote) on the dates and locations of the next two ACCGE meetings in 2013 and 2015. In both cases we will return to two very popular venues of the past: the 19th American Conference on Crystal Growth and Epitaxy (ACCGE-19) will be held July 21-26, 2013 in Keystone, Colorado (the site of ACCGE-15 in 2003), and ACCGE-20 will be held July 26-31, 2015 in Big Sky, Montana (the site of ACCGE-16 in 2005, near beautiful Yellowstone National Park). We have already negotiated contracts at both locations to lock in the dates and best possible pricing. In the future we will continue to schedule national meetings on a regular two-year cycle, and will try to rotate between these two locations (and perhaps a third) to simplify conference planning and build ongoing relationships with the host hotels. We also voted to change the terms of office of our officers (formerly 3 years) and executive committee (formerly 6 years, with half rotating off every 3 years) to 4 years to line up with our biennial national meeting (which was triennial when the terms were established), and we will ensure that member voting is completed in time for the results to be announced at the conference.

AACG membership was another major topic of discussion. A certain amount of chaos ensued after the sad and untimely death of Bill Bonner (since AACG was headquartered at his company Crysta11od and administered by his daughter Lori), and the membership roster fell out of date except for those attending the national or West coast conferences. If you are receiving this newsletter you will also be receiving an email from AACG giving you an opportunity to renew your membership. In the mean time we are working on enhanced AACG member benefits beyond this excellent newsletter to include a members-only password-protected area of the website with access to an up-to-date member directory, electronic copies of current and archived AACG newsletters, job-postings, and other valuable online content that we are gradually adding to our revamped website. If for some reason you don’t get a membership renewal reminder, you can renew now at http://www.crystalgrowth.org/. If you have some of your own ideas for additional AACG member benefits, please send them to aacg@comcast.net.

It’s a great honor for me to serve as the president of the AACG for the next four years. I continue to really enjoy all my interactions with the crystal growth community, and I look forward to seeing you all at a meeting in the near future. I hope you can make it to our next conference, the 23rd Conference on Crystal Growth and Epitaxy – West (ACCGE/West), June 3 - 6, 2012, at Stanford Sierra Camp, Fallen Leaf Lake, CA. Submit your abstracts at the conference website by April 16th! http://www.crystalgrowth.us/accge-west23/index.php

In your service,
Pete Schunemann
AACG President
AACG Executive Committee

Election Results

On behalf of the AACG and myself I would like to congratulate the new officers and offer our thanks to all nominees. I would also like to give a vote of thanks to the outgoing officers President Jeff Derby and Vice President Marek Skowronski. As a volunteer organization the strong participation by all these folks has maintained the strength of the AACG.

The AACG Executive Committee consists of 24 elected members, who are chosen in staggered six year terms, 12 each election cycle as was just completed. We wish to congratulate the newly elected/re-elected members of the Executive Committee whose names are given in italics in the list below.

Gordon Banish
Robert Biefeld
Dave Bliss
Lynn Boatner
Edith Bourret-Courchesne
Jeff Cederberg
Jeff Derby
Jim DeYoreo
John Geisz
Bill Higgins
Tom Kuech
Steve Licht
Candace Lynch
Irina Mnushkina
Shari Motakef
Chris Orme
Aleks Ostrogorsky
Joan Redwing
Alexana Roshko
Darrell Schlom
Pete Schunemann
Rose Scripa
Bob Sekerka
Marek Skowronski
Peter Vekilov
Dave Vanderwater
Chris Wang
Simon Watkins

Contributed by Vince Fratello, Nominations and Elections Chair

AACG-18 Review

The 18th American Conference on Crystal Growth and Epitaxy was held in conjunction with the 15th Biennial Workshop on Organometallic Vapor Phase Epitaxy on July 31 to August 5, 2011 at the beautiful Hyatt Regency Monterey Resort and Spa in Monterey, California. The attendance consisted of 284 regular participants, 66 students, 5 one-day participants, 7 exhibitor participants, and 30 vendor exhibitors.

The conference began with a welcome reception for participants on Sunday evening (July 31st). The technical program began on Monday, August 1st with two plenary lectures; one from Dr. Alan Janos from the Department of Homeland Security entitled “The Importance of Crystals to Homeland Security and the Mission of the Domestic Nuclear Detection Office” and the other from Dr. Chris Orme from Lawrence Livermore National Laboratory.

Over the course of the week, technical presentations and posters were presented that covered topics related to organometallic vapor phase epitaxy, III-V nitride and wide bandgap materials, materials for photovoltaics, nanoscale materials, thin film stress, epitaxial growth, biocrystallization, bulk crystal growth, industrial crystal growth, correlated electron crystals, detector materials, fundamentals of crystal growth, modeling, nonlinear optical and laser materials and novel materials/future trends.

The social program included a banquet which was held on the evening of August 3rd for all participants and an optional excursion to a local winery on the afternoon of August 4th. The meeting concluded at noon on Friday, August 5th.

Contributed by Joan Redwing, AACG Secretary
Joseph Wenckus
(1928-2011)

Joseph Francis Wenckus, of Naples, FL, formerly of Needham, MA and Moultonborough, NH on Lake Winnipesaukee, died on Sunday, July 17, 2011 at Avow Hospice in Naples. He was 83. He was born in Cambridge, MA on January 20, 1928, son of Theodore Wenckus and Anna (Demolles) Wenckus. Raised in Avon and Cambridge, MA Joe was a graduate of Northeastern University, class of 1951.

Joe was a major player in the founding of the American Association for Crystal Growth (AACG) as well as a Life Member, having served in multiple capacities as an officer. He was editor of the AACG newsletter from 1971 until 1979. He had a key role in helping to establish the International Organization for Crystal Growth (IOCG) in the mid-sixties. His superb leadership in organizing and operating the first IOCG Conference in Boston in 1966 (IOCG-1) developed the template used in succeeding conferences domestically (AACG), and around the world (IOCG). Joe was also an emeritus member of the American Ceramic Society. In addition to his contributions to the scientific literature, he held at least six U.S. patents on topics including cold crucibles, laser formation of refractory fibers, uniform Czochralski growth, and the synthesis of inorganic compounds.

Joe learned about skull melting in 1972 during the USSR Conference on Crystal Growth (Tsakhkikadzor, Armenia, SSR) which resulted in his collaboration with V.V. Osiko. During that time Joe was employed by Arthur D. Little. That work led successfully to the study, design, and fabrication of a cold crucible system that was delivered to the Air Force during March of 1975. The Air Force (AFCRL-TR-75-0213) was interested in the synthesis and crystal growth of refractory semiconductors and oxides and Joe’s work aided immeasurably in that regard. In 1992, Joe and V.V. Osiko received the Laudise Prize from the International Organization for Crystal Growth. Both were cited for their understanding and development of the extremely difficult techniques required to reproducible grow large quantities of high quality refractory crystals. They were also recognized for the implementation of skull melting for growth of cubic zirconia and for its successful commercialization as a gem material worldwide. The Laudise Prize, named in honor of R.A. Laudise, is awarded for significant technological contributions to the crystal growth field.

Joe founded Ceres Corporation in 1976 in a garage in Massachusetts to manufacture cubic zirconia, which is used to make artificial diamonds for jewelry. The company’s name stemmed from the use of cerium to stabilize the cubic phase of zirconia. Ceres also invented and marketed a device (Ceres Reliance AC Diamond Tester) to enable anyone to easily tell the difference between diamond and cubic zirconia in a ring without removing the stone from its setting. The device utilized the difference between the thermal conductivity of cubic zirconia and diamond and was patented by Ceres Corporation in 1979. Joe became founder and president of its manufacturer, Ceres Electronics Corporation, in 1982.

The Joseph F. Wenckus Fellowship at MIT’s Department of Material Science and Engineering, founded in 1998, provides a scholarship to first year students adjusting to the fiscal demands of a graduate education. Joe loved Porsche automobiles. He had been a member of the Porsche Club of America since 1961. He also enjoyed building radio controlled airplanes and was a member of the AMA (Academy of Model Aeronautics) for a number of years. He was preceded in death by his wife Alleen and
is survived by his son, Gregory Wenckus and his wife, Kassandra Bernard; daughter Stephanie Wenckus; two grandchildren, Riley Anne and Joseph Thomas Wenckus.

Letter from V.V. Osiko:

The information about Joe Wenckus’ death was quite unexpected and shocking for me and for my wife. We both were very close familiar with Joe and his family: his wife Alleen and his children Stephanie and Gregory. We visited each other several times.

Our first contact took place in 1966 at the first International Conference on Crystal Growth in Boston. In the same year we met in Moscow at the International Crystallography Congress. Since that time we began to meet each other regularly at different conferences and business meetings. Joe was a very positive and open person, and communications with him were always optimistic and joyful.

Joe Wenckus was (how difficult to use this word!) a talented scientist and engineer. Working at the A.D. Little Company he designed and built several crystal growth furnaces. Each of these creatures had many brilliant engineering decisions. Well known is his contribution to the skull melting technology and commercial production of cubic zirconia crystals. For this work he was awarded with R. Laudise Prize of the International Organization for Crystal Growth. He is an author (or co-author) of many valuable articles on crystals which are well known in the crystal growth community. We will never forget our dear friend and colleague Joe Wenckus.
Dr. Bruce Chai is the president of Crystal Photonics, a Florida company producing scintillator crystals for Positron Emission Tomography scanners. He was an invited speaker at the International Workshop on Crystal Growth Technology in Berlin (IWCGT-5) in June 2011 where David Bliss obtained this interview for the AACG Newsletter.

DB: How did you get started and where did you get your first opportunity in crystal growth?

BC: This is really interesting. I got my college degree in Taiwan, majoring in geology, but that was not really my interest. Then I did my graduate work at Yale where my thesis became more geochemistry and then moved towards materials science. I switched to engineering. So my biggest interest at that time was to study interfaces. Liquid-solid-gas interfaces; how the atoms move across interfaces, by diffusion, or migration. That includes defects, like screw dislocations and so forth. The interface transport model was my main interest. At that time, I have to mention that I met Bob Laudise. He is the one who introduced me into the crystal growth world.

DB: Was this when you were at Yale?
BC: Bob Laudise was an adjunct professor at Yale, so he came up to visit several times. So I was listening to his talks, and somehow he liked me. I was looking at interface models, and of course hydrothermal growth is partly an interface phenomenon. So he remembered me when I graduated with my PhD, and he had a buddy from his MIT days, named Alton Gilleo. Alton also had worked at Bell Labs for many years, and then moved to Allied Chemical, where he worked on GGG for magnetic bubble memory. He was hired by Jack Gilman, the Director of Material Research at Allied Chemical. Gilleo was trying to grow aluminum phosphate (AlPO) for a SAW device. That was where I started. Alton asked Bob if he could recommend someone for a position at Allied. Bob said, “I know this kid at Yale; call him, he’s a good guy”. So one day I got a phone call – “I have this position, could you come over and talk?” I had no clue what it was about, so I gave a talk about my thesis that nobody could understand, and then Alton said “When are you going to start?” I told him I didn’t know anything about what they were doing, but he assured me “don’t worry about it—just come in”, at that
time Allied Chemical was a very big company. Sometimes the circumstances are just right and sometimes we are just being lucky.

DB: Were there others you knew from Bell Labs as well?
BC: There is another gentleman to whom I owe a lot, even today, and that was Ernie Buehler. Buehler worked with me for eleven years. He actually worked at Bell for fifty years before retired at age sixty-five, a true Bell Labs guy, starting at age 15 as an apprentice in the machine shop around the time of the Depression. He couldn’t finish school, and he decided to become a machinist – that’s how he got into Bell Labs. He was very skillful, but he decided that instead of staying as machinist, he wanted to be a research technician. He worked with A.C. Walker, and he grew the first quartz crystals even before Bob Lau-dise.

DB: Why did Buehler come to Allied?
BC: He reached the age of mandatory retirement at 65, but he was still able and willing to do some work. So Alton hired him to help me with crystal growth. The first time I met Ernie, I thought, “my God, this guy is an encyclopedia of crystal growth activities at Bell Labs”. He was the first one to grow quartz crystals and also the first one to grow silicon single crystals by direct melt pulling method, that we now called Cz method. It really should be called the Buehler method to be fair. He had grown mercury cadmium telluride and a whole list of other compounds. Working with him, he was my mentor, I learned all about the history and people at Bell. I became almost like an employee of Bell Labs, even though I never worked there.

DB: What happened with the project at Allied?
BC: You see aluminum phosphate is a very difficult crystal to grow; it has retrograde solubility and difficult to increase crystal size once all the facets were formed. Eventually, Allied lost interest in AlPO. So they switched me into optical crystals. I started working on Cr-doped tunable solid state laser crystals. At that time Gilleo passed away, and Bob Morris took over as the manager. I continued working in solid state laser materials because Allied had a contract with Lawrence Livermore to investigate new materials for laser fusion and other things.

In February 1988 Ernie died right in my laboratory at Allied. I was really, really sad. He was almost like a father figure to me with all the years we had worked together. In the beginning, he had showed us his technique, and eventually, I developed a team to work on the crystal growth technology.

DB: Was that a turning point for you?
BC: At that time CREOL of University of Central Florida was looking for a professor of optical materials, and the search committee called me and asked if I would be interested in coming down to Florida. At first I told them no, but then I thought with Ernie gone, maybe it was time to make a change. So that is how I moved to Florida as a professor. At that time, I was still working primarily on laser crystals and nonlinear optical materials.

DB: How did you make the transition to lutetium silicate crystals?
BC: I knew Chuck Melcher from Schlumberger. He had a task to develop new scintillators. I had once offered to help him to set up the crystal growth laboratory at Schlumberger. After I became a professor, Chuck called me and explained that he was having problems with this new crystal, LSO. He asked me to become a consultant to help him to solve the crystal growth issues back in 1991. The mystery problem was that some of the LSO crystals had very nice scintillation properties but others were very poor.

Unfortunately, I could not help him to solve that problem then. I only found the solution nearly 10 years later. At that time a new company called Computer Tomography
Imaging Inc., CTI, was interested in using LSO crystals for PET. In 1993, CTI decided to license the LSO patent from Schlumberger, and in doing so, they essentially hired Chuck Melcher as part of the package. Schlumberger was looking for good scintillating crystals for oil drilling and logging, but LSO was unusable because Lutetium has one long half-life natural radioactive isotope.

DB: Was this the time when you started your company?
BC: I started Crystal Photonics, Inc. (CPI) in 1995 with only $150,000 cash. The company was originally to develop substrates for gallium nitride LEDs. 1995 was a pivotal year for me. My students were graduating and looking for jobs. The new company offered work opportunities for them. A few years earlier, I was consulting for LOC with Paul Johnson to set up their YLF production. In return, they gave me some stock. That year, LOC was bought by II-VI Corporation, and suddenly my LOC shares were worth something. It was part of my start-up money.

Another thing that happened in 1995 was that one day I got a phone call from my old boss, Bob Morris of Allied, who offered to donate all their crystal pullers to the university since the company ended the crystal research program a few years earlier. I told Bob that I was just starting a new company and needed crystal growth equipment. So why not sell them to me instead? He agreed to sell to me all the Allied crystal growth equipment for $50K. This gave a good start for my company with 5 working crystal pullers and RF generators. Back in late 1995, there was also a short period when the Iridium price was down to only $80 per Troy ounce, so I was able to buy several Iridium crucibles for less than $20K apiece. These all happened within a very short period of time after I started the company. At the same time, CTI was also decided to launch the LSO project and asked me to develop the growth process for mass production, which I accepted.

DB: Does CTI also have crystal growth facility in Tennessee?
BC: Yes, in Knoxville. I began to set up the crystal growth facilities in Florida for mass production of LSO. Once our facility was working, they decided that they needed two sources, one internal and one external. So I helped them build a plant in Knoxville to produce LSO as well. Once they became self-sufficient, CTI told me they didn’t need me any longer, because they had a sufficient supply of crystals internally. We sued them to recover some of our losses, and we also held our own patent on LYSO, which has certain advantages over LSO. It turns out that both GE and Philips needed the LYSO crystals to be competitive on high-end PET market with Siemens. If Siemens or CTI had the wisdom and bought me out back then, they would have no competition today. But I think that competition is a good thing for the medical market. Now we are a full-size company with 130 crystal pullers, working 24 hours, in full production.

DB: Is that why Siemens does not use LYSO today?
BC: Siemens has the LSO patent so naturally they will use it in their PET scanners while GE and Philips use LYSO.

DB: Do you think the customers know exactly what they want, or do you have to interact with them to come up with specifications?
BC: We interact with our customers all the time. I’ve been working with GE for ten years. We may give them a crystal for trial, and they will analyze it and try to find an application. Depending on the market, they may say the crystal is too expensive. Crystal cost is an important factor for commercial usage. But today, for the high end systems, it is a bearable cost. It turns out that for the whole PET scanner system, there are two items that are most expensive -- the PMT and the crystal. Those are the major costs of the system.

So all three PET manufacturing companies tried to squeeze their PMT suppliers, Hamamatsu and Photonics (it used to be a part of the Dutch company Philips), to lower the price. Now Photonics is out of the PMT business. So Hamamatsu is the only PMT supplier in the world today. We also get great pressure from our customers to reduce our crystal price.

DB: You have been extremely successful in the crystal growth business. What do you think is the future for crystal growth in America?
BC: As my old boss, Alton Gilleo, once said, you are only successful as a crystal grower when you are able to produce and sell at least one ton of crystals per month. I think that is a good criterion to show success. Fortunately, I can say we are there today. I think there are other opportunities, but they will not be easy. In the past there were many crystals like GGG, YAG, LiNbO3, and LiTaO3, that have reached that level. But today they all have faded somewhat in importance.

DB: Will there be other opportunities to achieve that type of success?
BC: Potentially, yes. For example, right now sapphire growth is going crazy for the LED business, and quartz will persist for many years to come. For SAW devices, both niobates and tantalates will be used for IF filters on cell phones. They are going to be there forever. But new materials will become much more categorized than in the past. An example would be to eliminate the PMT from PET-scanners, you will need CdZnTe. But you will have to solve the growth problem of this crystal. If you can solve it, then CdZnTe will be the next material that you can make by the ton. For any new materials, you must satisfy the need of the technology. Right now there is a big market for scintillator crystals like iodides in both medical and homeland security. They are starting to use lanthanum bromide as well. So it really depends on the market and the national objective. I can’t say there won’t be other successful ones, but those are the ones I see as being successful today.

DB: So what do you see for crystal growth in the future?
BC: Right now, I would say the biggest deficiency is that there are no US universities that provide any program to train for bulk crystal growth. So most of the learning today is on-the-job training. The problem with this kind of training is that even though new people can become good crystal growers, in a real sense, they are only highly qualified technicians. Since they do not know the basics, they are workers, not thinkers. I think for the future, we need a balance, where you have people growing crystals, but you also have people thinking about new materials. This is what is lacking, if we are ever going to find any new material, it will require a very stringent multidisciplinary curriculum. Another way that might work is to set up a mentor system, where a new graduate from university will find a good mentor in industry. I would like to see the next generation proceed along these lines – with mentors from industry. I know that now-a-days companies are worried about competition. They may want to keep their trade secrets and will not allow such mentor system. But on the positive side, the company may get a good new hire.

So I think that a mentor system is the best way to pass along people’s knowledge forward to the next generation. I think the worst thing that a person can do is to bury his or her knowledge in the grave.
2012 Harold M. Manasevit Young Investigator Award

Award Guidelines

Description: The Harold M. Manasevit Young Investigator Award is an international award that recognizes the exceptional technical contribution(s) of a young investigator working in the Metalorganic Vapor Phase Epitaxy (MOVPE) technical area. The award will be given every two years at the International Conference on Metal Organic Vapor Phase Epitaxy (ICMOVPE), with the first award being presented at ICMOVPE-XVI in Busan Korea, 20-25 May 2015.

Eligibility: Eligibility is limited to contributors 35 years or younger during the year the award is given (2012). All members of the International MOVPE technical community satisfying the above restriction are eligible to be selected.

The primary requirement for eligibility for this award will be the publication of one or more high-quality technical paper(s) in refereed technical journals in subject areas that are normally covered by the ICMOVPE conferences.

Nomination Process: Nominations for the award can be made by any member of the MOVPE technical community (no self-nominations will be accepted). Nominations require a minimum of two and a maximum of five supporting letters of reference from individuals in the MOVPE community who are knowledgeable about the Nominee’s contributions.

The Nomination should include a citation of 25 words or less which succinctly describes the excellence of the contribution for which the candidate is being nominated. Nomination form is available on-line at www.crystalgrowth.org/xxxxx or at www.icmovpe2012.org/. Nomination form and all supporting letters must be emailed to aacg@comcast.net on or before 15 March 2012 to be considered by the Awards Committee.

For further information, contact the AACG administrator, aacg@comcast.net. Forms and information available at www.crystalgrowth.org.
ProChem, Inc. was founded 1986 as a high purity inorganic chemical manufacturing company. For the past 25 years, ProChem has been supplying the crystal growth industry with high purity metal oxides, rare earth oxides, and other inorganic compounds. ProChem has always been very active with the AACG and takes pride in knowing that our products are being used in so many different high tech applications.

ProChem materials can be found in some of the following products: Precision Optics, Synthetic Rubies, New Photonics Devices, Fiber Optic Sensing Systems, Lasers and Laser-based Systems, Faraday Rotators for use in Optical Isolators, Clear and Colored heat resistant Borosilicate Glass, and High quality and Specialty Piezoelectrics and Dielectrics.

ProChem supplies high purity Potassium Dihydrogen Phosphate (KDP) as a starting material to Lawrence Livermore National Laboratories (LLNL). This material is used to grow the KDP crystals for the National Ignition Facility (NIF). ProChem began working with LLNL in 1988 and through this collaborative effort began producing the highest purity KDP available making it possible to grow crystals bigger and faster than ever before at an acceptable price.

ProChem operates from two separate manufacturing sites that encompass over 50,000 square feet of manufacturing space. ProChem continues to expand our product line to meet our customer’s exact requirements. We use 50, 100, and 200 gallon glass-lined reactors for high purity chemical production. ProChem has a hot oil system that can be utilized for high temperature reactions up to 230 degrees Celsius. We also have a chiller system that can be used in temperature sensitive reactions to hold the temperature below -5 degrees Celsius. We have in house analytical capabilities that minimize the time in between synthesis and shipping. This includes ICP-OES, AA, GC, FTIR and HPLC capabilities.

In addition, we use specialized outside contract analytical laboratories for ultra-high purity analysis like ICP-MS for parts per billion (ppb) and parts per trillion (ppt) trace analysis and XRD for conformational analysis. At ProChem, the customer is first and “WE REACT.”

AACG corporate profiles are provided to familiarize AACG members with companies that support the AACG as corporate affiliates, conference sponsors, or newsletter advertisers. Please contact the editor with suggestions for future profiles. There is no cost involved to the advertiser.
Position Openings

Current job openings are listed on the AACG website, along with additional details regarding the jobs posted below. If you would like to advertise an open position in the newsletter or on the website, please contact aacg@comcast.net.

Silicon Crystal Growth Engineer
Dow Corning Corporation

Position Description: The Silicon Crystal Growth Engineer will be a key member of an applied research and development team with a goal to develop silicon castings for photovoltaic (PV) applications. The work includes developing, evaluating and implementing process technologies for silicon metal conversion and optimizing processes to deliver customer required solar cell properties. The role will involve interaction with external organizations and universities as needed. The successful candidate is a self-starter, innovative and hands-on, and he/she is able to use fundamentals in material science & engineering to help the team succeed in its goals. Knowledge and/or experience in the PV or Semiconductor electronics industry preferred.

The position is located in Midland, MI. Ability to travel to customers, testing facilities, and other DCC sites globally is required.

Desired Qualifications: Applicants should be motivated to be part of a significant growth opportunity for Dow Corning and have an MS or PhD. in Metallurgy, Materials Science or related engineering discipline. Candidates with demonstrated experience in silicon crystal growth, specifically structure-performance property manipulation, will be given priority consideration. Demonstrated proficiency in hands-on development of process solutions is a significant advantage, as is the desire to innovate and document intellectual property. Demonstrated proficiency in leading project teams is beneficial. Proficiency in basic statistics and Six Sigma, including Design of Experiment (DOE) is desired. Applicants should have excellent oral and written communication skills and demonstrated ability to work effectively in cross-functional teams. We offer a competitive compensation based on skill and experience as well as a flexible benefits package.

Dow Corning is an Equal Opportunity Employer M/F/D/V. Our positions require applicants to possess a graduate degree from any accredited college or university, or a comparable foreign college/university.

View Job #1103 at https://www.dowcorning.com/content/careers/
Email c.stevens@dowcorning.com

Visit our website at www.crystalgrowth.org

ADVERTISE IN THE NEWSLETTER!

The AACG newsletter is the most effective medium for reaching the American crystal growth community.

Contact the AACG Administrator at aacg@comcast.net for more information.
Position Openings

Vice President, Advanced Materials Technology - New York State

Our Client Company is one of the world’s largest specialty chemicals and materials companies, with operations located to serve all major regions of the world with a broad portfolio of specialty performance products for industrial and consumer markets. Their materials are found in virtually thousands of end-use products, and touch nearly every facet of modern living.

The VP of Technology is an active member of the Advanced Materials Division Business Management Team (BMT). This role is responsible for managing a highly skilled, advanced degreed global organization with direct oversight of Global Process Technology, Corporate R&D, Analytical and Transformational Growth within the Company Division. This person will have oversight for the continues development of a robust R&D organization within the business units and managing all related R&D processes around new product introduction, intellectual property, Design For Six Sigma (DFSS) and Open Innovation. The VP, Technology develops and maintains external technical relationships through organizations, universities, and government funding.

This person is an active participant of the Global Company Growth Council. The Growth Council is focused on exploring ways to unleash the potential of The Company-by finding ways to harness and leverage technologies across the divisions-to realize growth and new business opportunities. The guiding principles of the Growth Council are to focus on identifying and prioritizing the items that can have the biggest impact on the business and then acting as an enabling body to operationalize them. Once items have been identified, the Council works to ensure that adequate resources and funding are in place to execute within the business teams.

Director, Crystal Development

Our client is a leader in the design and production of solid state radiation detectors. Their proprietary semiconductor production process for materials enables a new generation of higher resolution all-digital imaging equipment for medical and security applications. They offer a high energy entrepreneurial environment with competitive salary, benefits and equity with a rare opportunity to play a key role in building a marquee organization.

The Director, Crystal Development is a results oriented self-starter who enjoys a hands-on management role and has a broad background in process development and transfer between process development and regulated process manufacturing environment such as ISO or GMP. He/she is responsible for leading a compact group of scientists and technicians thereby conceiving, planning and developing the crystal R&D programs and rapid detector prototyping and evaluation. This position will work in close co-operation with both the manufacturing group and with detector development group to identify and transfer improvements in: methods targeted towards increased crystal yields, productivity and semi-conductor quality, crystal growth equipment, and in rapid prototyping of new crystal material in to standard detectors for quality evaluation. The management of longer term, strategic and collaborative R&D projects for the development of our state-of-the-art crystal technology to new applications will also be a feature of the job. This will require project management and coordination of these projects with associated external partners and funders.

He/she has an impressive track record of managing process development and optimization, working closely with multi-disciplinary teams, both internal and external, and taking projects from concept through to transfer into a regulated production environment.

To apply please send your resume to:
Doug Harrington at Austin Professional Search
email: drh@austinprosearch.com telephone (512) 795-9059
The 2012 AACG-West meeting is an interdisciplinary conference that emphasizes the fundamental understanding of nanoscale physics and chemical processes relevant to materials growth. The meeting takes place at the beautiful Fallen Leaf Lake Lodge, an intimate venue with nearby hiking and boating. Communal dinners and single session formats allow time for both formal and informal discussions.

**Conference Chair:**
Sean J. Hearne
Sandia National Laboratory

**Program Chairs:**
Luis A. Zepeda-Ruiz
Lawrence Livermore National Laboratory,
David Kisailus
University of California Riverside

**Keynote Speaker:**
Dr. Linda S. Sapochak
Program Director
NSF Solid State and Materials Chemistry division

**Conference Topics:**

### Biomaterials Growth and Processes
During the past years scientists have paid more attention to the modifications introduced by biomolecules in the crystallization or assembly of both inorganic and organic materials. A complete understanding of the mechanisms for growth or assembly and their effect on mechanical properties is of vital importance in many areas of engineering and medicine. This session will address applied and fundamental studies in the areas of biological and pharmaceutical molecules. Experimental and theoretical/computational studies addressing crystallization, self-assembly, morphology control, organic-inorganic interfaces and evolution of biomolecules are welcome.

**Invited Speakers:**
Jim De Yoreo
Lawrence Berkeley National Laboratory
William Landis
University of Akron
Janet Moradian-Oldak
University of Southern California

### Energy Materials Growth and Applications
Global energy consumption is accelerating beyond our current capacity to match demands. Global energy demand is expected to more than double by mid-century and triple by 2100. More than 85% of our energy comes from non-renewable fossil fuels; if the demand forecasts are correct, many current resources will be depleted by 2050. Today, renewable sources comprise only 7% of total energy production. Because of the large amount of energy available in the form of solar radiation, solar-based hydrogen fuels, or wind power, the combinations of these offer a potentially viable alternative form of renewable energy to completely meet the world’s growing energy demand. In addition, new developments in solid-state lighting technologies will reduce some of our energy demands. In order to address these concerns, new and existing materials must be fabricated to enable significant improvements in device performance. Thus, a thorough understanding of the nucleation and growth processes must be attained in order to fabricate materials with precise control over crystal size, phase and morphology.

**Invited Speakers:**
Jianyu Huang
Sandia National Labs
Howard Katz
Johns Hopkins University
Joshua Kuntz
Lawrence Livermore National Laboratory
James Speck
University of California Santa Barbara

### Fundamentals of Materials Growth
Though growth in crystalline materials has been studied extensively for nearly 100 years, the processes and dynamics of crystal growth are still at the forefront of research with material systems that impact everything from semiconductors to turbine blades. In this session, we will focus on fundamental processes active during growth of crystalline materials, such as mechanical properties (e.g. stress evolution), atomistics of growth processes, nano-
dots, nano-particles and nano-wire growth. The session will also work to emphasize, and build connections between, the wide array of growth techniques currently in use, e.g. MBE, CVD, LVS, electrodeposition.

**Invited Speakers:**
Bruce Clemens  
Stanford University  
Jonah Erlebacher  
Johns Hopkins  
Hanchen Huang  
University of Connecticut  
Nico Sommerdijk  
Eindhoven University of Technology

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‘Late News’ and Poster Abstract Submission Ends:  
05/25/2012

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**Upcoming Events**

**June 3-6, 2012**  
The 23nd Conference on Crystal Growth and Epitaxy – West  
Fallen Leaf Lake, CA  
http://www.crystalgrowth.us/acege_west23/index.php

**June 10-15, 2012**  
Gordon Research Conference on Crystal Engineering  
Waterville Valley, NH  

**June 20 – 22, 2012**  
Electronic Materials Conference  
University Park, PA  
http://www.mrs.org/emc2012/

**August 12-17, 2012**  
Gordon Research Conference on Defects in Semiconductors  
Biddeford, ME  

**September 11-14, 2012**  
The Seventh International Workshop on Zinc Oxide and Related Materials  
Nice, France  
http://www.crhea.cnrs.fr/iwzno2012/

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**AACG William Bonner Scholarship**

Each year the AACG will award $10,000 in scholarship money to a US member or members of the AACG who are working in the field of crystal growth.

This program was established in 2003 to assist qualified men and women working in the field of crystal growth to continue their education towards a technical degree. Individuals competing for these scholarships must be presently working in the field of crystal growth and must complete and submit an application form to the scholarship committee.

For an application form, contact Shoshana Nash at aaacg@comcast.net. For more information visit www.crystalgrowth.org

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Please submit conference information to the editor for inclusion in future issues.
Recent Government Contracts Awarded

Compiled by Mike Snure

**NSF SBIR Phase I**

$149,848

“Epitaxially Grown GaSb Thin Films on GaAs Substrates For Near-Field Conversion of Heat to Electricity”

MTPV LLC
8 Saint Mary’s Street
Boston, MA 02215

**NSF SBIR Phase I 2011**

$174,897

“High Power, High Efficiency Micropixel Ultraviolet Light Emitting Lamp”

Nitek Incorporated
1804 Salem Church Road
Irmo, SC 29063

**NSF SBIR Phase I 2011**

$179,974

“Enhanced Reflectivity GEMM Materials for High-Efficiency and Low-Cost III-Nitride LED Technology”

Lightwave Photonics, Inc.
1106 Second Street
Encinitas, CA 92024

**NSF SBIR Phase II**

$423,988

“Scalable Bulk GaN Crystal Growth”

Inlustra Technologies LLC
5385 Hollister Ave.
Santa Barbara, CA 93111

**NSF SBIR Phase II**

$500,000

“Hydrothermal Growth of Potassium Beryllium Fluoroborate (KBBF) for Deep UV Nonlinear Optical Applications”

Advanced Phototonic Crystals, LLC
377 Rubin Center Drive
Fort Mill, SC 29708

**DOD Army STTR Phase I 2011**

$100,000

“III-nitride 1.5 Micron Photonic Devices on Si Substrates”

III-N Technology, Inc
4627 5th Street
Lubbock, TX 79416-4727

**DOD Navy SBIR Phase I 2011**

$80,000

“Piezoelectric Single Crystal Property Assessment for Cost-Effective Optimized Naval SONAR Transducers”

Weidlinger Associates, Inc.
375 Hudson St FL 12
New York, NY 10014

**DOD Navy SBIR Phase I 2011**

$69,995

“Full Spectrum Solar Cell Using Novel Material”

Radiation Monitoring Devices, Inc.
44 Hunt Street
Watertown, MA 02472-4699

**DOD Navy SBIR Phase I 2011**

$80,000

“Tunable RF Band-Pass Filters Based on Multi-ferroic Nanocomposites”

Structured Materials Industries
201 Circle Drive NorthUnit # 102
Piscataway, NJ 08854-3723

**DOD AF STTR Phase I 2011**

$99,996

“MWIR lasers using Type II quantum well active regions on InP substrates”

Princeton Lightwave, Inc
2555 Route 130 South, Suite 1
Cranbury, NJ 08512

University of Virginia
351 McCormick Road.
Charlottesville, VA 22904-4743
DOD AF STTR Phase I 2011
$99,995
“Low-cost, low-defect Solvothermal growth of large
diameter Gallium Nitride substrates”
Solid State Scientific Corporation
27-2 Wright Road
Hollis, NH 03049
University Massachusetts Lowell
1 University Avenue
Lowell, MA 01854

DOD AF STTR Phase I 2011
$99,833
“Next Generation Thermoelectric Devices”
MicroXact, Inc.
2000 Kraft Drive Suite 1207
Blacksburg, VA 24060
Virginia Polytechnic Institute
Physics Department Robeson Hall
Blacksburg, VA 24061-0203

DOD AF STTR Phase I 2011
$99,999
“Solvothermal growth of low-defect-density gallium
nitride substrates”
Advanced Photonic Crystals LLC
377 Rubin Center Drive Suite 207
Fort Mill, SC 29708
Clemson University
415 H. L. Hunter Laboratories
Clemson, SC 29634

DOD AF STTR Phase I 2011
$100,000
“Solvothermal growth of low-defect-density gallium
nitride substrates”
Soraa, Inc.
485 Pine Ave, Goleta, CA 93117
University of Akron
302 Buchtel Common
Akron, OH 44325

DOD MDA SBIR Phase I 2011
$99,974
“Fast Wafer-Scale Characterization Techniques for
CZT”

CapeSym, Inc
6 Huron Drive
Natick, MA 01760

DOE SBIR Phase I 2011
“Novel Polishing Process to Fabricate Ultra Low Thick-
ness Variation Diamond Substrates for Next Generation
Beam Tracking Detectors”
Sinmat Inc.
2153 SE Hawthorne Road
Gainesville, FL 32641-7553

DOE SBIR Phase I 2011
“Novel Method for Growth of Detector-Grade CZT
Crystals”
Capesym, Inc.
6 Huron Drive
Natick, MA 01760-1325

DOE SBIR Phase I 2011
“Ultra-Thin III-V Films for Tandem Photovoltaic Applica-
tion”
Nano Enertex, Inc.
4131 Grennoch Lane
Houston, TX 77025-2303

DOE SBIR Phase II 2011
“Growth of Large Diameter High-Purity Germanium
Crystals for Nuclear Physics Research”
Phds Co.
3011 Amherst Road
Knoxville, TN 37921

DOE SBIR Phase II 2011
“Efficient Manufacture of Extreme Surface Area Micro-
channel Plate Devices Functionalized by Atomic Layer
Deposition Thin Films”
Arradiance, Inc.
142 North Road
Sudbury, MA 01776-1142
ACCGE-18 Sponsors

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Heraeus

Northrop Grumman

ProChem inc.

SAFC

ThermaCraft Energy Services

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LayTec is a major provider of in-situ and in-line optical metrology used in a broad range of thin-film applications such as compound semiconductors, photovoltaic, oxide and organic deposition.

Founded in October 1999 as a spin-off of the Technical University Berlin, LayTec quickly became a market leader in compound semiconductor process monitoring instrumentation, especially for LED production.

In-situ metrology is used in industry and R&D institutes world-wide for optimizing material quality and obtaining run-to-run reproducibility in epitaxy-based optoelectronic and electronic applications. During MOVCD and MBE processes, in-situ tools provide direct access to all key epitaxial growth properties with extreme precision!

www.laytec.de
Twenty-third Conference on Crystal Growth and Epitaxy

Stanford Sierra Camp
Fallen Leaf Lake, CA
June 3rd – 6th, 2012

The 2012 AACGE-west meeting is an interdisciplinary conference that emphasis the fundamental understanding of nanoscale physics and chemical process germane to materials growth. The beautiful Fallen Leaf Lake Lodge is an intimate venue with nearby hiking and boating. Communal dinners and single session format allow time for both formal and informal discussion.

Sessions include but are not limited to:
• Biomaterials Growth and Processes
• Energy Materials Growth and Applications
• Fundamentals of Materials Growth

Abstracts on all topics of crystal growth and epitaxy are welcome.

Conference Chair
Sean J. Hearne
Sandia National Laboratory
sjhearn@sandia.gov

Program Chairs
Luis A. Zepeda-Ruiz
Lawrence Livermore National Laboratory
zepedaruiz1@llnl.gov
David Kisailus
University of California Riverside
david@engr.ucr.edu