International Titanium Association was established in 1984 with the mission of connecting the public interested in using titanium with specialists from across the globe who may offer sales and technical assistance.

We accomplish this by:

- Hosting the Titanium Resource Center;
- Educating through hands on workshops & online seminars;
- Producing the TITANIUM Conference series in the US and in Europe;
- Providing assistance in the form of accurate and timely information to potential designers, fabricators and end users of titanium, involved in generating, producing or disseminating information about titanium;
- Sponsoring the Titanium Online Library dedicated to preserving past conference proceedings from the World Titanium and annual TITANIUM Conferences;
- Administering 16 working committees all with a focus on marketing and technical objectives.
- TITANIUM EUROPE: 2014, the 2nd annual European conference & exhibition was held May 19-21st in Sorrento, Italy hosting 422 delegates. TITANIUM USA 2015, the International Titanium Association’s 30th anniversary meeting welcomed 948 guests in Chicago, Illinois.

By joining the International Titanium Association, you will be making connections with industry representatives and receiving up to date, essential information necessary to conduct business in the global titanium industry.
Current membership is comprised of over 200 organizations with over 1,500 individual members worldwide. Membership as of December 31, 2014:

A.D. Tubi Inossidabili SpA
Above Material Technology Co., Ltd.
Accushape™ Inc.
ACNIS ® International
Acnis do Brasil
ACMA Products, Inc.
Aerodyne Alloys LLC
Akrapovíc Titanium Castings LLC
Alcoa Howmet
ALD Vacuum Technologies, Inc
AlloyWorks, Inc
AMADA Machine Tools America, Inc.
American Titanium Works LLC
AMETEK - Reading Alloys
Architectural Titanium LLC
ATI
Avon Metals Ltd
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Banner Service Corporation
Baosi Jinheng Metal Material Co., Ltd.
Baosi Jucheng Titanium
Baosi Ronghao Ti Co., Ltd.
Baosi Titanium Industry Co., Ltd.
Baosteel Special Materials Co., Ltd.
Beijing Hangda Titanium Science & Trade Co., Ltd.
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Caledonian Alloys
Carver Machine Works, Inc.
CEFIVAL
Chaiyang Jinda Titanium Co., Ltd.
Chesapeake Industrial Cleaning Products, Inc.
China Huaxia Special Metal Limited
China Steel Corporation
Consarc Corporation
Continental Steel & Tube Co.
Cristal Metals, Inc.
CSIRO, Titanium Technologies
Cyri Bath Company
Danieli Corporation
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DHL Drawback Services
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EFC Systems Inc.
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Fluor Corporation
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FRIGGI N.A. Inc.
G & L Manufacturing
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Gautier Steel Ltd.
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GIE Metalle und Materialien GmbH
GIE Media Inc. - Industrial Division
Global Titanium Inc.
GNB Corporation
Grandis Titanium
GSL, Inc.
Haynes International Inc.
HEMPEL SPECIAL METALS GmbH
Hi Tech Alloys
High Performance Alloys, Inc
HORIE Corporation
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Independent Forgings & Alloys Ltd
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Industrial Metals International Ltd.
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Jiangsu Hongbao Group Co., Ltd.
KASTO Inc.
Keywell Metals LLC
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Monico Alloys, Inc.
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Nanjing Plate Titanium Industries
nanoPrecision Products, Inc
NF & M International Incorporated
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Nu-Tech Precision Metals
Oak Ridge National Laboratory
OJSC “Special Economic Zone” Titanium Valley
Olympus NDT
Osaka Titanium Technologies Co., Ltd.
OSCAR Production Group Ltd.
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PCC Structural, Inc.
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Plymouth Engineered Shapes
Praxis Technology
President Company Ltd.
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Roll Forming Corporation
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RTI International Metals, Inc.
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Yunnan Titanium Industry Co., Ltd
Zak, Incorporated
Zapp Materials Engineering GmbH
ZIROM S.A.
ZTMC Zaporozhye Titanium & Magnesium Combine
As we draw 2014 to a close, I look back at this successful year, which also happens to be a milestone anniversary for the International Titanium Association. We are grateful for having the support of our Member organizations, the Board of Directors and Committee volunteers.

In this anniversary year, we would like to take this opportunity to thank our predecessors Francine Rickenbach, John Monsees, and John’s daughter, Amy for helping to establish the foundation of what we call the International Titanium Association today.

Lastly, a special note to thank Stanley Seagle for his contributions to the ITA over the past 14 years of instructing the Fundamentals of Titanium workshop. Stan officially retired this year and we will miss his dedication, wisdom and insightful perception of the industry. Thank you for your service, time and enthusiasm for education.

Today, the ITA celebrates its largest membership with 226 organizations from 23 countries worldwide. ITA produces two successful conferences in Europe and the US with a combined attendance of nearly 1,500 annually. The Association also provides exceptional editorial content in the quarterly Titanium Today magazine which is now in its second year of publication.

In 2015 you will see development with ITA committee activities, continued expansion in Europe, more connections with Asia, and more options to associate with titanium industry professionals on the ITA website. The newly formed Women in Titanium committee will be hosting a variety of meeting dates in 2015 and will be developing a mentoring program to encourage ITA Members to become involved in this initiative.

In 2015 I encourage you to attend an ITA committee meeting, industry tour or the TITANIUM conference series. Come see how the Association has evolved and where we are headed. You will be glad you did!

Best regards,
Jennifer Simpson
The original Board of Directors, as identified in the original 1984 Articles of Incorporation were:
Conard Stitzlein, Astro Metallurgical
Jan G. Barkman, TIMET
John C. Durham, Chase Extrusions
Dominic Strollo, RMI-Titanium
Robert S. Nycum, Titanium Industries
Don C. Simmons, TiTech International, Inc.
C. Edward Nelson, Oregon Metallurgical Corp.

### ITA Officers

**ITA President**
Dawne S. Hickton
Vice Chair, President and Chief Executive Officer
RTI International Metals, Inc.
2015 ITA President
Dawne S. Hickton is vice chair, president and chief executive officer of RTI International Metals, Inc. (NYSE: RTI), a global supplier of advanced titanium products and services in commercial aerospace, defense, propulsion, medical device, and energy markets. Ms. Hickton became the CEO on April 27, 2007, and serves as a member of RTI’s Board of Directors. During her tenure as CEO, Ms. Hickton has guided RTI's transformation from a manufacturer of titanium mill product to an integrated, value-added supplier of titanium parts and engineered structures, touching entire supply chains throughout diverse markets.

Today, RTI has 21 manufacturing locations in North America and Europe and is widely recognized as a leading integrated supplier of technologically sophisticated titanium products.

Ms. Hickton serves as chair of the board of the Pittsburgh branch of the Federal Reserve Bank of Cleveland. She is an officer and member of the Board of Directors of the International Titanium Association and a member of the Board of Governors for the Aerospace Industries Association. Ms. Hickton also serves on the Advisory Council of the University of Pittsburgh Carnegie Mellon University.

Ms. Hickton is a 1979 graduate of the University of Rochester for the Aerospace Industries Association. Ms. Hickton also serves on the Advisory Council of the University of Pittsburgh for the Aerospace Industries Association. Ms. Hickton also serves on the Advisory Council of the University of Pittsburgh for the Aerospace Industries Association.

Ms. Hickton is a 1979 graduate of the University of Rochester and received her J.D. from the University of Pittsburgh, School of Law in 1983. She resides in Pittsburgh with her husband, U.S. Attorney David J. Hickton, and their children.

**ITA Vice President**
Hunter R. Dalton
Executive Vice President, ATI High Performance Specialty Materials Group / President, ATI Specialty Materials
Hunter Dalton joined ATI in August 1981. He was appointed the Manager of Manufacturing Engineering in March 1984. In October 1986, Mr. Dalton was promoted to Director of Purchasing for ATI Allvac's five facilities. He was named Plant Manager of the Monroe Billet Operations in September 1996 and promoted to General Manager of the Nickel & Specialty Steel Forged Products SBU in March 1998. In April 1999, Mr. Dalton was named Vice President of Operations and Continuous Improvement. Mr. Dalton assumed additional responsibility for Allvac Ltd operations in November 2001. In November 2003, he was promoted to Senior Vice President of Sales and Marketing. Mr. Dalton was named President of ATI Allvac effective April 1, 2008, and Group President of ATI Long Products effective October 1, 2008. In August 2010, Mr. Dalton also assumed responsibility for ATI Powder Metals business unit. In April 2011, Mr. Dalton was named Executive Vice President of ATI Long Products.

**ITA Secretary/Treasurer**
Henry Seiner
Vice President — Business Strategy
TIMET, Titanium Metals Corporation
Today's Aerostructures market is primed for growth. It is shaped by supply chain alignment, increasing oil prices, and decreasing interest rates. These factors along with a forecasted fleet of greater than 50,000 in 2035 and the OEM's record backlogs and build rates give rise to a bullish forecast for the titanium demand from the Aerostructures market.

Mr. Seiner, TIMET's Vice President of Business Strategy, oversees the Marketing, Product Management, Purchasing and Production Planning organizations for TIMET. In this role, he has responsibility for and visibility into all aspects of TIMET’s supply chain.

Henry is based in TIMET’s Toronto, OH facility — which is geographically and structurally in the middle of TIMET’s global supply chain. He has held various positions in Production Planning, Manufacturing, Purchasing and Marketing in his 23 year tenure at TIMET.

Prior to coming to TIMET, Henry spent six years at U. S. Steel Corporation in Sales, Marketing and Production Planning. His educational background includes a Masters Degree from Carnegie Mellon University in Pittsburgh, PA and a Bachelor’s Degree from Duke University in Durham, NC. Henry is a native of Pittsburgh and continues to reside in Western Pennsylvania.

**ITA Past President**
Brett S. Paddock
President & CEO, Titanium Industries, Incorporated
Brett Paddock is the President and CEO of Titanium Industries, Inc. (T.I.), one of the largest independent providers of High Performance Metal mill products. T.I. sells a full line of titanium products into major markets from its 16 global facilities, and provides supply chain management and value added services to a diverse global customer base.

In addition to serving as the President of the ITA board, Mr. Paddock is currently the Chairman of the ITA’s Grant Committee. His diverse metals background consists of engineering consulting, fabricating, manufacturing, contracting, and sales. Mr. Paddock holds a Bachelor of Science in Engineering, a Master of Science in Structural Mechanics from Lehigh University, and is a licensed professional engineer.
The International Titanium Association hosted TITANIUM EUROPE 2014 Conference and Exposition May 19 to 21 in Sorrento, Italy, as members of the European Union continue to work through economic difficulties in the aftermath of the international Great Recession of 2008/2009. Attendance at the gathering totaled 422 delegates. Speakers at the Sorrento gathering addressed the economic climate in Europe as it relates to the titanium industry.

At the 30th anniversary meeting of the International Titanium Association, speakers in Chicago, Illinois focused on links in supply chain and promises of 3-D technology. The event was held September 21 to 24 at the Hilton Chicago and drew 948 delegates from 25 countries. Presenters provided outlooks on world supply and demand, illuminated developments on the ever-lengthening, global supply chain, clarified near-term business trends driving the key commercial aerospace sector, reported on the dynamics of the titanium industry in China and Russia, weighed the use of titanium as a material for metal separators in fuel cells, and shared insights on the potential for 3-D titanium additive manufacturing as “a novel, game-changing technology.”

A complete overview of the most recent TITANIUM Conferences are available for download on the ITA Website.
Speakers at TITANIUM 2014 focus on links in supply chain, promise of 3-D technology

Celebrating a 30-year milestone, the International Titanium Association (ITA), Northglenn, CO, hosted its annual TITANIUM Conference and Exhibition Sept. 21 to 24 at the Hilton Chicago, 720 S. Michigan Ave. The gathering drew nearly 1,000 delegates from 25 countries and featured more than 60 exhibitors.

Summarizing the highlight presentations at the forum, speakers provided outlooks on world supply and demand, illuminated developments on the ever-lengthening, global supply chain, clarified near-term business trends driving the key commercial aerospace sector, reported on the dynamics of the titanium industry in China and Russia, weighed the use of titanium as a material for metal separators in fuel cells, and shared insights on the potential for 3-D titanium additive manufacturing as “a novel, game-changing technology.”
Grant /Scholarship Committee:

2014 Committee Members:
- Brett S. Paddock, President & CEO - Titanium Industries, Incorporated (Chair)
- Edward A. Sobota, Jr., President - TSI Titanium
- Edward J. Newman, Executive Vice President – Keywell LLC

Mission: To develop, promote and help all activities involved with ITA grants, which include but are not limited to the application development award and ITA scholarship programs.

Objective: Recommending awards and scholarship to contribute to the growth of the overall titanium industry and to promote the selection of titanium as a competitive material by providing fundamental knowledge about Titanium and its applications.

2014 Titanium Applications Development Award

Lightweight aerospace seat captures ITA’s Titanium Applications Development Award

The next time you travel on business or pleasure, and you happen to notice your airline seat is especially comfortable while sporting a streamlined, elegant, high-tech appearance, think about the joys, benefits and advantages that come from designing products with titanium.

Gilles Duval, the vice president of procurement for Expliseat SAS, Paris, is the recipient of the International Titanium Association’s (ITA) 2014 Titanium Applications Development Award. Nominated by his colleague, Vincent Tejedor, the company’s chief technical officer, Duval and Expliseat were recognized by the ITA for the development and commercial launch of a commercial aerospace interior cabin product simply known as the “Titanium Seat.”

Duval will receive the award at TITANIUM 2014, the 30th annual business conference, sponsored and organized by the ITA, which will be held at the Hilton Chicago, Sept. 21-24. Brett Paddock, the president of the ITA’s board of directors, served as chairman of the committee that reviewed Titanium Applications Development Award nominees. Paddock also serves as the president and chief executive officer of Titanium Industries Inc., a global distributor of titanium mill products based in Rockaway, NJ.

“Each year the grant committee receives dozens of nominees for the ITA Titanium Applications Development Award and this year was no exception,” Paddock said. “In fact, 2014 turned out one of our more impressive lists of nominees. Expliseat really shined because their product touched on many of the award criteria, such as introducing a new titanium application, presenting a new design using titanium, promoting titanium to replace a competitive material, among others. Plus, the successful commercialization of their titanium airplane seat on an Airbus A321 really reinforced Expliseat as deserving the award. We are extremely pleased to be presenting Expliseat with the $20,000 Titanium Applications Development Award at TITANIUM 2014 in Chicago.”

Winning the ITA’s Titanium Applications Development Award caps off a most successful string of events this year for Expliseat, Duval said. The company also garnered European commercial aviation certification for the Titanium Seat; signed its first contract and delivered product on time; and received the JEC award for its work in carbon-fiber composites (JEC is the largest composites industry organization in Europe). The Titanium Seat received EASA (European Aviation Safety Agency) certification approval on April 1, indicating it meets European Union safety standards for the Airbus A320 jetliner series.

Duval expressed his appreciation for receiving the ITA award, saying it reflects Expliseat’s “four years of hard work” to develop the Titanium Seat. “This is amazing. Our team is very proud and over-motivated for the next challenges. We are ambitious and never comfortable with being ranked second. This year was great for us and it’s not over yet.”

Along with its ergonomic design for enhanced passenger comfort, weight reduction is a major selling point for the Titanium Seat. Duval explained that the seat weighs 4 kg (9 pounds) per passenger, while the best competitor’s seat is twice that weight and the standard seats installed in most commercial aircraft weigh around 13 kg (29 pounds) per passenger. Duval touted the cumulative, long-term weight-saving advantages of the seat, saying it offers an annual fuel savings of up to $500,000 per aircraft.

He said that while the width of the seat is governed by the aircraft dimension, the Titanium Seat’s sleek design offers additional legroom at knee level when compared with a standard airline economy seat. Duval added that the Titanium
Seat structure and fixation “are totally new for aircraft seat design: new shapes and ergonomics, new materials and covered by several patents. Regarding fasteners, they are regular and standard commercial aerospace fastener. All interfaces are standardized by aircraft manufacturer.”

Expliseat’s first contract was to supply 220 seats to Air Mediterranee, a French airline, for an Airbus A321 aircraft. The delivery and installation was successful, Duval said. “We managed to deliver the seats without any delay and customer is very satisfied. We are a new company and we need to show that we are reliable and that we do what we say.” He said negotiations with another airline, to use the seat in a Boeing 737, are in the final stages of discussion, however he declined to provide further details.

In the Titanium Applications Development Award nomination form, Tejedor wrote that the airline seat uses titanium “in a completely new fashion, as a combination with composite, to get a strong, light and durable structure.” When asked to elaborate on this description, Duval chose his words carefully, citing Expliseat’s desire to maintain its competitive advantage and not divulge proprietary information to competitors. There are 10 patents on the Titanium Seat program, all internationally filed. He said Expliseat subcontracts production of the Titanium Seat with major industrial companies. “We have high flexibility and a huge production capacity.” Seats are assembled at a facility in Toulouse, France.

The Titanium Seat is manufactured through a combination of a near net shape process and machining, Duval declined to spell out details of the production technology, and said only that the carbon fiber composite and titanium are both “premium, aerospace grade materials.” He did, however, provide some insight in the seat design’s “new fashion,” saying that “in the process of shock absorption and energy release, both titanium and composite have their defined and precise task to do. Our seat is not just the lightest because we use light material. Each titanium part, in its defined position, has a role to play in the energy release process.”

This new fashion mentioned in the nomination form also involves the use of titanium, rather than aluminum or plastic, on the seat’s visible parts. “The parts that hold the food tray are made of titanium—literally unbreakable,” he said. “We never want to have to change them because it’s broken or keep a stock of spare parts for our customer. Airlines complain so much about low quality armrest or food tray, so using titanium is a real added value to them.”

Benjamin Saada, chief executive officer, Jean-Charles Samuelian, executive director, and Tejedor formed Expliseat, a privately held company, in March 2011. The goal for the company was to bring together innovation, ergonomic design and industrial efficiency in a single product: the Titanium Seat. Recalling the origins of the process to design and develop the Titanium Seat, Duval said Expliseat conducted a “deep analysis” of existing airline economy-class seats and market structure. He said most commercial airline seats are made of more than 500 parts and used only plastic and aluminum, so Expliseat identified an opportunity for a “clear breakthrough.”

Using advanced finite element analysis design tools and specifying carbon fiber composites and titanium and the materials of choice, the company was able to create a seat by using only 30 parts—all of which reduce production cycle times and yield the above-mentioned significant weight savings per part. Expliseat has no plans to license the Titanium Seat technology to other companies.

Duval earned a master’s degree from UCLA, Los Angeles, in Civil Engineering, then began his career at Aubert & Duval, Paris, a division of the Eramet Group, where he contributed to the development of a new business unit, UKAD, which was dedicated to the titanium industry. Aubert & Duval is a producer of high-performance specialty steels, closed-die forgings and superalloys. His experiences included dealing with a partner company in Kazakhstan that produces high quality titanium ingots. After three years he received an offer to join Expliseat. Today the company has more than 60 employees.

The company already has initiated a next-generation version of the Titanium Seat technology, which has the potential to find applications in aerospace and other transportation sectors. “What transportation industry isn’t eager for weight savings?,” Duval said, speaking rhetorically about finding new business opportunities to redeploy Expliseat’s technology.

Addressing a broad industry perspective, he said the underlying mission for Expliseat is to inspire “an increased demand for titanium products. I believe some industrial designers don’t even think about specifying titanium because (they feel) it’s expensive and unaffordable. But if you use titanium wisely, then yes, you can get added value from it.” Duval said his hope is that the Titanium Seat, as recognized by the ITA’s Titanium Applications Development Award, helps to usher in a new mindset for designers, engineers and inventors, encouraging them to rethink the use of titanium to create the next generations of industrial products.
CONGRATULATIONS
2014 Academic Scholarship Winners

Michael Rodriguez  David Woodfield

Emily Wilson  Sandia Akhtar

The 2014 Academic Scholarship Program brought to you by the ITA Grant Committee

Special Thanks to the following 2014 Sponsors:

ATI  RTI  International Metals, Inc.

among the missions of the international titanium association (ITA) are the promotion of new applications and material processing technologies for titanium and the recognition of research projects that contribute to these advances. These goals often intersect in academia, and at the Sorrento Conference this May, the ITA Education Committee welcomed five graduate students’ Research and Development exhibits.

Two Approaches for Improvements in Titanium Machining

Elio Chiappini and Stefano Tirelli presented two “complementary strategies for improving machinability and profitability of titanium and its alloys.” They included both simulation and experimental activities in their project. “We consider the research results very interesting for industrial applications in titanium manufacturing.”

Because titanium is hard to cut, due to its low thermal conductivity, alloys (specifically Ti6-4 in this research) require relatively low cutting speeds to avoid massive tool wear. Tirelli’s investigation compared turning with traditional oil-water coolant to cryogenic machining, with liquid nitrogen as the cooling medium. “The results showed that cryogenic machining is able to increase tool life with respect to wet cutting,” Tirelli said. It also reduces environmental impacts.

In addition, current low cutting speeds reduce profitability in machining Ti6-4. Chiappini’s work focused on cutting techniques that enhance the material removal rate. “A strategy of higher cutting depths could be used if not for the vibration caused by regenerative chatter,” he noted. His research examined the chatter suppression method of Sinusoidal Spindle Speed Variation (SSSV), which uses a non-constant cutting speed. The effects of this technique on the tool were examined using Finite Element simulations and experimentally validated in dry turning tests. Compared with Constant...
Speed Machining, SSSV fosters better tool wear mechanisms.

Chiappini and Tirelli emphasized that the cryogenic and SSSV machining techniques could be implemented simultaneously and the Finite Element Method simulations they ran could be useful for predicting thermal and mechanical loads.

**FORMING AND FINISHING TECHNIQUES FOR NEW TITANIUM JEWELRY DESIGN**

“Jewelry design represents an area where artistic and handcrafted approaches coexist with titanium’s industrial base,” stated Paola Garbagnoli, a Design and Engineering Graduate of Politecnico Di Milano who also received her Ph.D. from that university in 2014. She exhibited a Poster developed with four other graduates of the school (Valeria Masconale, Maria Vittoria Diamanti, Barbara Del Curto and MariaPia Pedederi) which showcased the testing and results of using laser melting and anodic oxidation – typical engineering techniques – to create titanium jewelry.

Laser melting technologies are currently employed in mechanical and biomedical applications, as they enable manufacture of extremely complex shapes with high precision. Coupled with 3D computer-aided modeling, Selective Laser Melting (SLM) allows a jewelry designer to build desired shapes by layering titanium powders. Since molds are not required, the method is well suited to fabricating unique, one-of-a-kind pieces, Garbagnoli said. “The application of SLM in jewelry design is very interesting and advantageous.”

After SLM processing, the pieces underwent finishing tests that included electro-polishing, tumbling, sandblasting and peening. “Each procedure creates a very particular effect and when this is combined with anodic coloring, the jewel can further increase in value,” she continued. The electrochemical anodizing of titanium leads to a range of aesthetically appealing, iridescent surface colors. It also makes the jewelry surface biocompatible and anallergenic, which are important characteristics for contact with the skin.

“Our project was developed in collaboration with designers, materials engineers and chemical engineers: indeed, the aim of the work was the identification and development of innovative applications for titanium. Thanks to its chemical and physical properties, a fascinating material such as titanium is very promising for jewelry design,” Garbagnoli concluded.

**TITANIUM RACE CAR COMPONENTS FOR WEIGHT, PERFORMANCE IMPROVEMENTS**

Formula SAE is a circuit race organized by the Society of Automotive Engineers for single-seat, open-wheel cars designed and built by university students. Members of the University of Perugia, Italy’s racing team, Antonio Malizia and Alessandro Cimarello, recognized that titanium, with its high yield-strength-to-density ratio, could be used to achieve performance advantages in this event.

Their Poster detailed their design and production of titanium wheel hubs and suspension rockers for the RB11.1 car of the Unipg Racing Team. “The car raced the 2013 Formula SAE Italy Official competition at the Varano de Melegari circuit less than two years after the kick-off of the project,” Malizia and Cimarello noted.

Francesco Fantozzi, Faculty Advisor for the project, explained that the SAE race “was designed to bridge the gap between the solid background in engineering disciplines provided by the University and application in the industry. It introduces engineering students to practical industrial design by engaging them in a competition of race cars which are designed, constructed and run. The goal, in brief: to build the most competitive, and safe, vehicle for the least cost.”

The two students’ choice of titanium for unsprung wheel hubs was made because of the weight reduction it realized versus steel hubs. Titanium reduced the total weight of the four hubs “the equivalent of reducing the overall weight of the car by 10%, to produce a remarkable increase in driveability and grip performance,” Cimarello and Malizia said.

The hubs are made from Grade 5 titanium machined from billet, then heat treated and turned to meet final tolerances. The feedstock for the hubs was provided by ITA member and sponsor company TiFast. Marco Costanzi of the company commented, “TiFast always tries to collaborate with academic institutions.” He added, “The TiFast billet was first machined in a semi-finished form by one of the sponsoring machining companies, annealed and stress relieved by TiFast, then finished by the same machine shop. In this way the wheel hubs reached an optimum of dimensional retention, surface finish and mechanical properties. The parts were a perfect fit for the car and performed as designed during the competition.”

For the suspension rockers, titanium was used to increase mechanical strength compared to previously-used aluminum, with a negligible increase in sprung mass. “The goal was to reach the right compromise between light weight and strength,” the students explained. “The titanium increased the component reliability enough to race the Varano de Melegari circuit without damage.” The rocker plates were water-jet cut from Grade 4 slab, which was less expensive than machining from billet, and then epoxied to an aluminum bushing.

Stress-strain analysis of the hubs and suspension rockers was accomplished using Finite Element Methods and the loads used in design were calculated with software that simulated vehicle dynamics on a lap of the circuit.

“It’s a great opportunity, for recent graduates as we are, to participate in this ITA conference,” Cimarello and Malizia said. “And to meet principal players in the industry, be updated on advanced and innovative technology and give our little contribution to this wonderful event.”

**Best Master Dissertation Program**

The ITA’s Education Committee this year selected Peyman Samimi of the University of North Texas department of Materials Science and Engineering and Center for Advances Research and Testing, and Darpan Shidid, a Ph.D. student at the Center for Additive Manufacturing, RMIT University, Melbourne, Australia, as the recipients of the “Best Master Dissertation” awards.

Graham P. Walker, vice president, sales and marketing for AMETEK Reading Alloys and Dr. Markus Holz, president, AMG’s Engineering Systems and division chief executive officer of ALD Vacuum Technologies GmbH are the co-chairs of the Education Committee. Both men are members of the ITA’s board of directors.

Samimi’s dissertation described a “Combinatorial Assessment of the Oxidation Behavior of Titanium Alloys: Examples of Binary Ti-Mo (molybdenum), Ti-Cr (chromium), Ti-Al (aluminum) and Ti-W (tungsten) Systems.” The dissertation paper stated that, at elevated temperatures, titanium suffers from poor oxidation resistance and loses its resistance to corrosion. “This limits the service temperature of titanium in application to about 550°C (1020°F). Although the high-temperature oxidation of titanium and titanium alloys has been a subject of several research efforts, such studies however are often constrained to the composition of specific alloys and neither the mechanisms associated with evolution of oxide layers nor the effects of oxygen on the microstructure of the material are well-understood.”

In order to explore the influence of composition variation on the oxidation behavior, Samimi said a combinatorial approach was adopted whereby a series of compositionally graded specimen, (Ti-xMo, Ti-xCr, Ti-xAl and Ti-xW) were prepared using an additive manufacturing approach, and subsequently exposed to still-air at 650°C (1200°F). “A suite of the state-of-the-art characterization techniques including scanning and transmission electron microscopy as well as atom probe tomography were used to assess, as a function of the local average composition: the structure and composition of the oxide, the oxide adherence and porosity, the thickness of the oxide layers; the depth of oxygen ingress; and microstructural evolution of the base material just below the surface but within the oxygen-enriched region.”

Shidid’s dissertation focused on the “Design and Manufacture of Patient-Specific Jaw Implants Using Selective Laser Melting.” Shidid said osteosarcoma, an aggressive type of bone cancer, typically requires radical surgical treatment
The committee continues to support continuing education through the following programs:

**Fundamentals of Titanium**

**Instructor:** Stanley Seagle

This workshop, offered online and in-person several times per year, is the premier course on “everything titanium.” It has been presented all over the world in several languages.

Stan Seagle has been involved with titanium industry since the industrialization of the metal since the early 1950's. He spent the early portion of his career developing titanium alloys in the research department of what is now RTI International Metals. Several of the alloys he developed are being used in both aerospace and commercial applications. After 15 years, in the lab he moved from research to marketing where his efforts were developing non-aerospace applications. Stan was very much involved in introducing titanium to the pulp & paper industries. He also promoted titanium for use in the oil & gas industry and dabbled in the world of automotive. After this tenure in marketing, Stan was promoted to Vice President of Technology which included the production area as well as marketing, research, and development. After 38 years, he retired from RTI and has pursued consulting work which included instructing hundreds of titanium professionals in the Fundamentals of Titanium workshop.

**How to Weld Titanium**

**Instructor:** Randy Dull

Arc Welding – Edison Welding Institute

Mr. Dull has expertise in arc welding processes, including gas tungsten arc welding (GTAW), plasma arc welding (PAW), gas metal arc welding (GMAW), flux-cored arc welding (FCAW), submerged arc welding (SAW), and shielded metal arc welding (SMAW). He has experience with low-current GTAW and PAW applications. Materials joined include carbon steels, coated steels, stainless steels, cast iron, aluminum alloys, titanium and titanium alloys, nickel alloys, copper and copper alloys, and silver. He has additional expertise in arc welding automation, weld tooling, off-line robotic programming, distortion control, and flame straightening. He developed and taught training courses on welding-related subjects including PAW, GTAW, GMAW, FCAW, welding of nickel alloys, welding of high-strength steels, welding of light metals, robotic arc welding, arc welding optimization, control of distortion, and welding inspection.

**Titanium and Combustible Metal Safety**

The ITA Safety Committee sponsored session at the TITANIUM 2014 conference providing a general overview of topics. Speaking on the topic of fire prevention and general plant safety in the titanium industry, Robert G. Lee, the chair of the ITA’s Safety and Compliance Committee, who also serves as president of Accushape Inc., Portland, OR, urged conference attendees to “understand how your materials react and how your processes can create ignition conditions.”

Lee underlined that there are at least 10 different types of titanium powders and fines and at least a dozen factors that influence their potential flammability and ignition. He said static electricity is a “likely culprit” of spontaneous ignitions. Avoid having fire water sprinkler systems inside plants were titanium is stored or processed.

The most dangerous forms of a combustible metal, like titanium, are dust, powders, and “swarf.” Swarf is a term used to describe fine scrap. Swarf and dust and powders represent major fire hazards because they are susceptible to ignition, while large titanium castings and ingots generally are not combustible under ordinary conditions.

Kevin L. Kreitman, the fire chief of Redding, CA, provided an overview on National Fire Prevention Association’s Combustible Metal Standard (NFPA 484). Kreitman, who has written technical papers on combustible metals and metal dusts and is an instructor at the U.S. National Fire Academy, Emmitsburg, MD, addressed TITANIUM 2013, held in Las Vegas.

NFPA 484 was created in 2002 by incorporating the requirements of six individual combustible metal standards, including NFPA 481 Standard for Titanium, into a single document. The six individual standards became chapters in the new standard. Kreitman said the updated 2015 standard for combustible metals is important to all titanium companies as it provides guidelines for the production, processing, finishing, handling, recycling, storage and use of titanium alloys in a form that is capable of combustion or explosion, especially metal dust and powders. The various chapters in NFPA cover administration, reference publications, definitions, determination of...
combustibility, advice on facility management to minimize hazards, fire prevention and emergency response, general “housekeeping” rules, and suggestions on the control of ignition sources and dust collection.

In 2015 the committee will be disseminating information to Suppliers and Users of Titanium Products; Providing referrals through the Titanium Resource Center to safety experts who may provide guidance to prospective members of the public; Building on-line awareness programs; Encouraging Safety Committee Members to Participate in Other Organization Standards and Compliance Groups; and hosting annual or quarterly meetings to Discuss Safety Incidents.

The ITA does not make specific recommendations regarding safety because the precise conditions are not known to ITA. Producers and users are responsible for conducting their own research and establishing appropriate policies and procedures for the safe operation of their facilities and use of titanium. The ITA does not report on or comment about news stories, or reports about specific incidents as ITA has no way of verifying the accuracy or applicability of such information.

The 2014 Titanium Achievement Award recognizes those who have dedicated their lives to the titanium industry who have exhibited outstanding qualities of leadership, and has been directly responsible for accomplishments that positively impact the titanium community.

Mission: To recognize those who have dedicated their lives to the titanium industry who have exhibited outstanding qualities of leadership, and has been directly responsible for accomplishments that positively impact the titanium community.

Objective: Review and conduct research on incoming ITA Member nominations to determine candidates for the Titanium Achievement Award for recommendation to the ITA Board of Directors.

As a fitting symbol of the respect that members of the International Titanium Association (ITA) hold for Dr. Paul Bania and his three decades of work inventing new titanium alloys and improving the melting and processing of the metal, the ITA has honored him with its Lifetime Achievement Award for 2014.

Bania received the award during the ITA’s 30th Anniversary annual conference in Chicago on September 22. “I was stunned,” Bania said about the honor. “If you look at the list of the people who’ve won this, many were my mentors. A lot of these folks I’ve known throughout my career. It’s an extreme honor to be recognized by the ITA and put on the list with those folks. I was very surprised, very humbled by it.”

“I had the honor of calling Dr. Bania to tell him he had won and he was flabbergasted, to say the least,” related Edward Sobota, Jr., TSI Titanium, and chair of the Award Committee. Only 17 ITA members have received the Achievement Award since its inception in 2000. Eight of those past winners, plus Sobota, selected Bania from a field of eight nominees. “The Committee members were very knowledgeable about who has made contributions to the betterment of the industry. The Award is a very highly regarded honor for those who’ve received it,” Sobota commented.

Michael Metz, VSMPO Tirus US, nominated Bania based on “his outstanding contributions to developing new alloys, refining melting and mill processes, and implementing these alloys and processes.” John Monahan, also of VSMPO Tirus US, elaborated that Bania’s contributions...
to the industry are “both well-known and clearly established. In addition, to many of us, Paul is still the very best technical communicator we have ever known.”

During a 17-year tenure at TIMET, Bania participated in the formulation of eight titanium alloys and received four patents for melting and production advances. While there he served as Corporate VP, Quality and Technology and ultimately led TIMET’s R&D facility, stated Paul Allen, TIMET.

At TIMET, Bania invented a simple, extremely effective method of reducing low density inclusions in rotating grade aerospace alloys, by shearing sponge to a small size that prevented the defects from surviving the VAR melting process. “I had an idea that I proved with some laboratory work to greatly reduce the incidence of these defects. As it turns out it worked and reduced the defect rate by over a factor of 100. We implemented it and put it into commercial use for as long as we produced that type of sponge. It turned out to be very significant because our defect rate was unacceptable and it turned into very acceptable,” he said.

Bania also worked on the creation of a new generation of oxidation-resistant, high-temperature beta alloys that were first used by Boeing for aerospace gas turbine engine components. Dean Musi, NF&M International, explained “Beta-21S has been an important aerospace alloy for over 20 years now and is still the ‘gold standard’ for resistance to catastrophic corrosion by hot aircraft hydraulic fluid.” The alloy spawned a new generation of titanium applications in high temperature aerospace service and its usage on commercial aircraft is still expanding, Musi said.

“A lot of times you get ideas that become patented but don’t become large or commercial successes,” Bania commented. “At TIMET, some of my greatest satisfaction came from the patents that were put into commercial use.”

Musi also credits Bania with helping lead the industry’s R&D efforts into the 21st century. In the early 70’s, with cancellation of the B-1 Bomber, research was near dormant for almost a decade. “The 1980’s brought a renewed interest in R&D and Paul championed the effort at TIMET’s Henderson Technical Lab. His tenure resulted in numerous new alloys and processing inventions,” Musi said.

Other alloys he invented included Ti-5111, which is used for naval applications with critical strength and toughness demands and is currently employed on Virginia class submarines, as well as an alloy suited to new applications for titanium in automotive springs and axle components. In addition to the sponge shearing technique for aerospace grade melting, his process patents include one for pack-rolling of challenging materials such as titanium aluminides.

In 1998, Bania formed TiPro LLC (in partnership with TIMET) to supply titanium into the auto racing industry, acting as both metallurgist and supplier to firms manufacturing valve train parts. “Most pleasing to me was maybe my 10 years at TiPro,” said Bania. “The company started at zero, nothing, and developed commercial relationships with customers and vendors. And I think it did a very good job of serving customer and vendor needs.”

By buying and re-selling downgraded aerospace engine alloys, he enabled racing part manufacturers to source higher grade metal and mill product manufacturers to profit from material that would have otherwise been scrapped. “The manufacturers were able to sell material that was still acceptable for my racing market and my customers got higher quality metal to make stronger, more fatigue-resistant parts,” he said. “It just took one guy with an idea. I wasn’t a special guy. It just needed that connection. I became the titanium metallurgist for these companies, so it served their needs and it served a company like TIMET’s needs. It ironed out the supply chain. It was a win/win.”

“His work with the automotive racing community brought a new level of technology for use of titanium in that industry;” summarized Musi. Bania built TiPro into a firm with several million dollars in annual sales, sold his interest to TIMET in 2009, and now runs a consulting company, PJBTiPro LLC, in a relationship with NF&M, which in turn is owned by VSMPO. Bania continues to expand the automotive aftermarket and serve as the lead technical authority in the titanium industry, according to Musi.

The ITA’s Lifetime Achievement Award was established “to honor and celebrate colleagues who have made a positive impact on the industry,” according the Jennifer Simpson, Executive Director the organization. In choosing Bania for the honor, said Sobota, “there was not just one item or one achievement he contributed. It was his many contributions over decades — different innovations, practical research that really made a difference. I wouldn’t say it was any single instance of what he’s done; rather it was a lifetime of work.”

Bania received his doctorate from the University of Cincinnati while working at Wright Patterson Air Force Materials Lab and began his career with Avco-Lycoming. He is recognized worldwide as an authority on titanium metallurgy, has taught courses on the subject for ASM and co-edited and written numerous books, papers and presentations. He has also obtained the Russ Ogden Award from ASTM for distinguished contribution in the field of Reactive and Refractory Metals.
Trade Show Committee

2014 Committee Members:

Jerry St. Clair, President - Vulcanium Metals International, LLC (Chair)
Lawrence D. Buhl III, CEO - Lawrence Holdings
John Crane, Communications Manager – EVRAZ Stratcor, Inc.
Thomas Deming, Compliance Manager - Titanium Industries, Incorporated

Mission: To help facilitate the expanded use of titanium based products in existing and new market sectors and applications by enlarging the knowledge about Titanium through promoting at trade shows and distribution of collateral materials.

Objective: To contribute to the growth of the overall titanium industry, and to promote the selection of titanium as a competitive material providing fundamental knowledge about Titanium and its applications.

ITA exhibits at a variety of trade shows throughout the year, disseminating information about the properties and applications of titanium metal and alloys and introducing booth visitors to our Member organizations.

The trade show committee reviews upcoming trade shows annually to make formal recommendations to the ITA Board of Directors. In 2014 the ITA hosted a booth display at:

<table>
<thead>
<tr>
<th>Conference &amp; Expo (Corrosion)</th>
<th>Medical</th>
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<tr>
<td>Corrosion 2014</td>
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<td>of Orthopaedic Surgeons</td>
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<td>AeroMat Aerospace</td>
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<td>Ti-EXPO 2014</td>
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<td>AeroCon Aerospace</td>
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The committee meets after each event to discuss the success of the campaign.

Applications Committee

2014 Committee Members:

Frank L. Perryman, President and Chief Executive Officer – Perryman Company (Chair)
Henry S. Seiner, Vice President – Business Strategy – TIMET, Titanium Metals Corporation (Aerospace)
Rob Henson, Manager, Business Development - VSMPO Tirus US (Industrial)
Susan Abkowitz, RTI International Metals, Inc. (Medical)

Mission: To help facilitate the expanded use of titanium based products in existing and new market sectors and applications.

Objective: To contribute to the growth of the overall titanium industry and to promote the selection of titanium as a competitive material by identifying new market sectors and applications and communicating this information to the other ITA committees in support of their annual goals and objectives.

The Applications committee includes 4 sub groups: Medical, Industrial, Aerospace and Consumer. The mission of each group is to help facilitate the expanded use of titanium based products in existing and new market sectors and applications. The objective of each sub group is to contribute to the growth of the overall titanium industry and to promote the selection of titanium as a competitive material by identifying new market sectors and applications and communicating this information to the other ITA committees in support of their annual goals and objectives.

Current responsibilities of each sub group include:

- Recommending trade shows where ITA should exhibit for the following year.
- Recommending topics for collateral materials to the trade show committee on an as needed basis.
- Collaborating & reviewing editorial topics for the quarterly Titanium Today trade publication.
- Maintaining Buyer’s Guide products & services categories to ensure there are no duplicates or unaccounted items in the Titanium Resource Center.
- Developing market specific general sessions, inviting appropriate panel speakers and make recommendations for distinguished speakers at TITANIUM Conferences.
- Solicit individuals or organizations that might qualify to apply for the annual Titanium Applications Development award.
- Gather & recommend ideas for the promotion of titanium metal in ITA published literature and ITA website content.
- Outline potential organizations that are not yet Members of the ITA and assist in the referral of those organizations who might qualify for ITA Membership.
- Evaluate opportunities to assist in technical development within the titanium industry (non-proprietary alloys, specifications, etc.).
- Evaluate methods to address concerns of potential users of titanium and ensure an industry interest in their application regardless to the size of the application, material used or market segment.

All ITA members are encouraged to participate in one of the sub groups. Please contact the ITA if you are interested in learning more about current projects.
REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) is the new EU regulation on chemical substances and is directly applicable in all EU Member States as well as Norway, Iceland, and Liechtenstein. It is a complete and radical review of policy on chemical substances. Most chemical substances currently placed on the EU market are subject to registration with the European Chemicals Agency (ECHA) by their manufacturers and/or importers. REACH will require registration for each chemical substance manufactured or imported into the EU in quantities of one tonne or more per year with few exceptions.

Registration is completed by submitting a registration dossier consisting of a technical dossier and chemical safety report. Parts of the technical dossier must be submitted jointly by manufacturers and/or importers of the same substance. In addition, REACH imposes a data-sharing obligation on manufacturers and/or importers of the same substances to ensure that studies and tests are conducted only when necessary, especially if the tests involve animals.

The Consortium enables manufacturers and importers to join forces and comply with the requirements under the REACH Regulation (2007/2006) for the registration of titanium. In particular, the Members undertake to identify, propose and perform joint studies including vertebrate animal studies for the purpose of Registration. More specifically, the Members aim to achieve uniform pre-Registration of the Relevant Substances and preparation and submission of Core Data for the Registration of the Substances and, to that effect, they undertake to review and share existing data, fill data gaps, and share the costs incurred in developing missing data.
DAWNE S. HICKTON ASSUMES PRESIDENCY OF ITA EXECUTIVE BOARD; LAUNCHES NEW INITIATIVE TO BRING MORE WOMEN INTO TITANIUM INDUSTRY

CHICAGO—Dawne S. Hickton, vice chair, president and chief executive officer (CEO) of RTI International Metals Inc., Pittsburgh, has been tapped as the first female president of the executive board for the International Titanium Association (ITA), a trade association founded 30 years ago. Now, in a spirit of stewardship and outreach, Hickton said she would like to establish a permanent path for other women to follow, so that they too can develop meaningful careers in the global titanium industry.

In order to help illuminate that path, Hickton—in her role as the president of the ITA—plans to establish a “Women in Titanium” committee as a way to inspire young women to consider careers and leadership roles in the titanium industry. Initial discussions for such a group took place at TITANIUM USA 2014, the ITA’s annual industry conference and exhibition, which was held in Chicago. The ITA formally introduced new officers for its executive board on Sept. 23, during the Chicago gathering.

Hickton recalled how top executives at RTI served as mentors and provided her with guidance and opportunities early in her career. As such, her resume reflects numerous accomplishments in the titanium industry, including her recent appointment as the leader of the ITA board. She became the CEO of RTI in April 2007 and serves as a member of RTI’s board of directors. Hickton has guided RTI’s strategic transformation—from a manufacturer of titanium mill product to an integrated, value-added supplier of titanium parts and engineered structures, serving supply chains throughout diverse international markets. RTI has 21 manufacturing installations throughout North America and Europe. She is especially knowledgeable on business trends in the global aerospace industry—the titanium sector’s largest market.

She has over 25 years of diversified metals experience, including more than 16 years in the titanium industry. Prior to joining RTI, she was employed at USX Corp., Pittsburgh, where she worked not only with the parent organization, but also with its subsidiaries: US Steel, American Bridge Co., and US Steel Mining Co. From 1994 to 1997, she was assistant professor of Clinical Law at the University of Pittsburgh. She serves as a director of the Federal Reserve Bank of Cleveland, Pittsburgh Branch and a trustee for the University of Pittsburgh. She is a 1979 graduate of the University of Rochester, Rochester, NY, and received her juris doctor (JD) degree from the University of Pittsburgh’s School of Law in 1983.

In recent years, Hickton and other ITA leaders have focused on the need for industry stewardship programs; dedicated efforts to cultivate the next generation of titanium designers, engineers, metallurgists and executives. Each year the ITA recognizes an industry pioneer with its “Lifetime Achievement Award.” Concentrating on stewardship, in many ways, is the other half of the equation—sustaining the achievements of those early leaders, while creating opportunities for young people to pursue careers in the titanium industry. The ITA’s “Women in Titanium” initiative is part of that overall effort.

Last year, Hickton’s commitment to stewardship and education was highlighted when she was tapped as one of the “top 100 CEOs leaders” in the United States to support 21st Century STEM learning and workforce development. STEM Blog, a project of STEM Connector, cited Hickton’s work to promote STEM (Science, Technology, Engineering and Mathematics) national education programs in public and private schools.

As spelled out in its mission statement, the Washington D.C.-based STEM Education Coalition works with the federal government and other organizations to raise awareness of the critical role that STEM education plays in enabling the United States “to remain the economic and technological leader of the global marketplace of the 21st century. Members of the STEM Coalition believe that our nation must improve the way our students learn science, mathematics, technology and engineering and that the business, education, and STEM communities must work together to achieve this goal.”

While specific plans for the ITA’s emerging “Women in Titanium” program are still in the early stages of development, outreach efforts are likely to include a scholarship fund, earmarked for young women, in order to encourage careers in material sciences and the titanium industry. In addition, the program may sponsor and organize regional mentoring programs, where female college students are invited to visit titanium companies and gain hands-on experience. This would involve substantive interaction between students and mentors. The ITA also may form alliances with other industry associations that have established similar mentoring programs for women.

Hickton’s call for an ITA “Women in Titanium” program comes into sharper focus when viewed against the backdrop of the national STEM campaign. She urged those working to promote STEM education to develop meaningful, long-standing partnerships with businesses in order to understand what types of STEM skill sets are needed in the workplace.

Quoted in a 2013 online interview posted on the STEM Blog (http://blog.stemconnector.org), Hickton described how her company has put forth a comprehensive strategy to connect diversity awareness with the STEM education thrust. RTI, she said, has an ongoing interest in recruiting material science (metallurgy), accounting/finance, engineering and IT professionals.

“As a business leader and woman in the STEM field, I am passionate about finding ways to increase the number of women and minorities in the field,” she told the STEM Blog. “I’m passionate about increasing the number of candidates with strong STEM backgrounds, because RTI’s reputation as a leader in ‘Advancing Titanium’ depends upon it. We believe that committing early to student education in the STEM fields will build robust pipelines of future STEM employees. Diversity initiatives are a core principle of RTI’s strategic plan, and we use that commitment to support and encourage diversity in STEM fields.

“When we are identifying and selecting viable STEM candidates for anticipated openings, our goal is to identify at least one minority and one female for every open leadership position,” she continued. “Women and minorities are vastly underrepresented in STEM fields, so this is a challenge, but one that we embrace. We must seek ways to make it attractive for U.S. students, especially women and minorities, to choose STEM careers.”

Hickton, in the STEM Blog interview, underlined the need to produce more technical school and college STEM majors, in order for the United States to maintain its leadership as a global economic powerhouse for industrial innovation. “Top-notch STEM professionals are critical for American businesses to stay at the forefront of global innovation, but our technical schools, colleges and universities are not graduating enough of these professionals to meet the demand,” she warned. “We must develop and support rigorous math and science curriculums in all American elementary and secondary schools so that there is a wide and deep pool of graduating seniors that are genuinely prepared for technical school and college-level STEM studies.”
## INTERNATIONAL TITANIUM ASSOCIATION

For the year ended December 31

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