Development of Robotic GMAW Workcell for Fabrication of Ti6Al-4V Machine Gun Receivers

The US Army is developing and fielding a number of vehicle and armament systems that use titanium. Due to the intent to transform the Army into a lighter, more transportable force, Army Research and Development facilities have incorporated titanium into the structure of many designs. The M240 machine gun is a 7.62mm gas operated machine gun that currently uses a riveted steel design for the weapon receiver (figure 1). The total weapon weight of the steel design is 27 lbs. Designers have determined that by using Ti6Al-4V (Grade 5) titanium in the receiver, the total weapon weight could be reduced to 22 lbs—a total weight savings of 5 lbs (figure 2). In order to implement this design change successfully in a high volume production environment and at an acceptable production cost, the titanium receiver would have to be welded by a robotic workcell.

The robotic welding of titanium, especially by gas metal arc welding, is not a common technique found in fabrication facilities today. Automation of titanium welding is usually restricted to electron beam and mechanized (orbital) gas tungsten arc processes or plasma arc welding processes. However, manual welding by gas tungsten arc processes is by far the most common technique used for the welding of titanium. The processes used are suggestive of the industries requiring fabrication of titanium components. Structural aerospace applications generally require electron beam, while structural aerospace repair or casting repair generally use manual gas tungsten arc welding. Heat exchangers, piping sy-
What’s New in Titanium?

Plymouth Extruded Shapes Receives “Outstanding Performance” Award By the Boeing Company, Commercial Airplanes Group

Warrenville—IL- Plymouth Extruded Shapes, a member of the Plymouth Tube Company, is pleased to announce it has been honored by an “Outstanding Performance Supplier” award from The Boeing Company, Commercial Airplanes Group, Wichita, KS. Boeing recognizes Plymouth as a supplier of outstanding performance since March 2000. The award is for 100% on-time and 100% quality in support of Boeing, Wichita for supplying titanium extrusions for production of seat track used in the Boeing 777 aircraft. This reinforces Plymouth’s status as a preferred supplier.

Plymouth Extruded Shapes offer extrusions in titanium, stainless steel, alloy steel and nickel based alloy. Extrusions can offer labor and material cost savings versus welding, forging, casting or machining of parts from bar or plate. Production flexibility and reduced cycle times are also potential benefits.

Product applications include aerostructure components, jet engine components, industrial valve bodies and fittings, press brake tools and a wide variety of parts used in the manufacture of pulp and paper, food, chemicals, petrochemicals and various types of machinery and equipment for the transportation and waste management industries.

Photo: Don States (right), Materials Procurement Agent, Boeing, Wichita presents “Outstanding Performance Supplier” award plaque to Karl Weiss, General Manager, Plymouth Extruded Shapes, a member of the Plymouth Tube Company, during the 2001 ITA Conference in Las Vegas, Nevada.

For more information, contact Gary Ezell, Aerospace Extrusions Product Coordinator, (270)886-6631 or (800)718-7590, e-mail: extrusions@plymouth.com

Plymouth Extruded Shapes can be found on the web at www.plymouth.com/extrusions.

TIMET Launches Automotive Division

(NYSE: TIE) TIMET announced the formation of a division specifically to serve the automotive industry and its growing requirements for titanium. The new division, named TiMET Automotive, is headquartered at the Company's Morgantown, PA facility. Its establishment formalizes TIMET's intention to significantly expand its engagement with the automotive industry. The new division is headed by Kurt Faller, who has been leading TIMET's automotive initiatives for several years.

"TiMET Automotive is a natural step in the progression of the automotive strategy we initiated in the mid-1990s," said J. Landis Martin, Chairman and CEO of TIMET. "The need to meet the conflicting goals of achieving higher mileage and lower emissions and improving safety has caused automobile manufacturers to increase their application of light weight materials. Titanium provides performance characteristics in the automotive environment that are unmatched by other metals. The objective of TiMET Automotive is to optimize the titanium production processes, controls, quality procedures and supply channels to meet the needs of the automobile industry," continued Mr. Martin. "An integral part of our strategy is to provide the best value titanium mill products to automotive industry oriented quality standards," Mr. Martin added.

The consumption of titanium by auto industry original equipment manufacturers ("OEM's") for use in automobiles, trucks and motorcycles is expected to approximate 1100 metric tons in 2002. While this volume is modest compared to other automotive metals, it represents substantial growth over the estimated 100 metric tons used by OEM's globally in 1995. Equally important, this growth is taking place in all 3 of the world's primary auto producing regions - the United States, Europe and Japan. Titanium's success in automotive racing and other performance applications is now being translated into consumer vehicles. At least 17 OEM's are currently using titanium for an array of components ranging from engine valves and connecting rods to wheel rim screws, exhaust systems and suspension springs. Additional components are in development or testing.

Titanium's unique combination of low mass, high strength and strong resistance to automotive environment

Continued on page 4
What’s New At ITA?

2002 ITA Buyers Guide

The International Titanium Association (ITA) will release the revised 2002 Buyers Guide this May. The updated Buyers Guide will be available on both a CD-Rom and the ITA web site located at www.titanium.org.

Currently the On-Line Buyer’s Guide receives over 1,000 visits per month - that’s over 1,000 potential customers learning more about your organization on a monthly basis with the ability to contact you simply with a click of their mouse!

As a Member of the ITA, your company is entitled to be included in the 2002 Buyer’s Guide CD-ROM. The revised Buyers Guide provides a complete profile about your company with Web Links to your individual company’s Web Site and E-mail contacts so that prospective customers may contact you directly about the products and services they require.

The On Line Buyer’s Guide is divided into 4 sections:

1. The Search By Products feature of the Buyer’s Guide allows visitors to select specific product(s) to narrow their research.

2. Search By Company Name allows visitors to have the ability to find member companies Sales and Technical Representative information, e-mail links as well as your complete company description.

3. The Search By Services feature allows visitors to select specific services offered by ITA Member companies. Visitors receive a complete description of the services your company provides along with contact information of your sales and technical representatives.

4. The Link To Member Web Sites allows visitors to learn more about your organization simply with a click of their mouse. Immediately they are linked to your web site from the Buyer’s Guide.

Members should submit all updates and changes to Stacey Jorgensen no later than March 31, 2002. Information can be submitted either by email to: sjorgensen@titanium.org or faxed to (303) 404-9111.

Member Referral Program

Earn credit toward your membership dues by referring new companies to the Association. The membership referral program provides an incentive for existing members to reduce their dues while bringing in new membership to the Association. It’s as easy as 1 2 3!

1. Complete the membership referral form (available by contacting the ITA at 303-404-2221 or download the form by visiting the Members Only section of the ITA web site at www.titanium.org.

2. ITA will mail a membership application to the new company.

3. Once the new company joins ITA, the referring member will receive a discount equal to 50% of the new member’s dues for the following renewal year.

Example 1:
Level 1 ITA member who pays annual dues of $1,000 refers a $1,000 Level 1 producer who joins the ITA. ITA referring member receives $500 credit on the following year’s renewal dues.

Example 2:
Level 15 ITA member who pays annual dues of $40,000 refers two companies: 1) Level 3 $2,500 payer and 2) Level 10 $13,000 payer who both join the ITA during the calendar year. ITA referring member receives $7,750 credit on the following year’s renewal dues. (2,500 + 13,000 / 2 = $7,750)

To learn more about the Membership Referral Program, please contact ITA or visit the Members Only section of the ITA web site at www.titanium.org.

Rules & Restrictions:
The discount will not exceed the total value of the referring member’s dues level. i.e. If referring member is a $4,500 level payer, and a $10,000 level payer joins ITA under the referral program, referring member would receive a discount of $4,500 on the following year’s renewal.

ITA members may refer as many companies as they wish, but the discounted dues will only be provided if the referred company joins the ITA. Referrals expire within 1 calendar year upon receipt by the ITA.
What’s New At ITA?

<table>
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<tr>
<th>ITA Exhibits at NACE</th>
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<td>This year the ITA is proud to participate as an exhibitor at the upcoming NACE Corrosion 2002 Exhibition on April 8-11, 2002 at the Convention Center in Denver, Colorado. Attending this show allows the ITA to represent the industry as a whole and continue to promote titanium usage. During the show, the ITA will distribute titanium literature and the buyer's guide thus further promoting our members.</td>
</tr>
<tr>
<td>ITA is requesting Member volunteers to assist in manning the booth. As a member of the Association this unique Member Benefit provides your organization the opportunity to promote your industry to potential customers. Participation from Member companies in promoting our industry efforts is always appreciated. To volunteer contact Stacey Jorgensen at (303)404-9400.</td>
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<th>TIMET Launches Automotive Division</th>
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<td>engineering challenges. The material makes possible engine components that increase horsepower and torque while improving fuel economy and solving noise, vibration and harshness problems. It offers lifetime exhaust systems that weigh approximately 50% less than traditional systems. Titanium suspension springs can give OEM's even greater mass reduction (up to 70%, in the range of 20 to 45 lbs per vehicle) over conventional springs, performing the same function in less space, allowing increased payload, and uniquely increasing engine compartment or passenger compartment space.</td>
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<td>“The reality is that titanium for automotive application is simply a lot less expensive than is commonly thought,&quot; said Kurt Faller, president of TiMET Automotive, &quot;particularly when you look at the life cycle cost of the material.&quot; Besides being much lower in mass, titanium exhaust components should easily last several hundred thousand miles and, except in extreme racetrack environments, are expected to exceed the life of the car. Titanium suspension springs save weight, require no corrosion allowance and no protective coatings, and do the same job in less space providing ever more valuable &quot;real-estate&quot; for designers to work with. Titanium components also resist corrosion in the automotive environment and, therefore, they retain much of the original material's value when they are recycled at the end of the vehicle's life.</td>
</tr>
<tr>
<td>&quot;Two of the more important tasks of TIMET Automotive are (i) to help OEM’s and component manufacturers see how titanium can cost-effectively improve their products, and (ii) to match our titanium products, processing facilities and production techniques to our customers' needs, further reducing costs as volumes grow,&quot; Mr. Faller said. &quot;In addition to our broad standard product line, we have three proven automotive-focused, proprietary titanium alloys to address specific needs. We have dedicated automotive product development, manufacturing and quality personnel on staff, and believe titanium is well-positioned for strong growth in the automotive industry,&quot; concluded Mr. Faller.</td>
</tr>
<tr>
<td>TIMET, headquartered in Denver, CO, is a leading worldwide integrated producer of titanium metal products. Information on TIMET is available on the Web at <a href="http://www.timet.com">www.timet.com</a>.</td>
</tr>
</tbody>
</table>

Executive Director Message continued from page 1
Annual Conference & Exhibition in Orlando, FL.

The conference & exhibition will be held October 6th - 8th. Over 40% of the exhibition space has already been reserved and we are expecting the largest attendance ever at this year's event. On line registration, call for papers, and exhibition reservations are now available by visiting the conference section of the ITA web site. I am also pleased to announce the discounted voucher program to ITA Members has been brought back, inviting all ITA Members to provide their clients and suppliers with a reduced registration rate of only $249 - 60% off the cost of members registration. The discounted vouchers will be provided to all ITA Members upon receipt of their 2002 dues.

This year, the ITA will have a presence at the NACE Corrosion show, the AWS Welding Show, Farnborough Air Show, and Aerospace Expo. Titanium literature and the 2002 Buyer's Guide CD-ROM will be provided at these shows to promote the products and services of our member companies. We appreciate receiving any changes to member profiles no later than March 15th to ensure that the CD is as accurate as possible.

If you have any questions concerning the activities of ITA, or suggestions for future projects the Association should consider, please contact me directly at (303)404-9300 or by email at jsimpson@titanium.org.
tems, and pressure vessel fabrication typically use mechanized orbital welding, either by gas tungsten arc welding or plasma arc welding.

In the case of the high production volume application of a machine gun receiver, as well as large structural applications, higher deposition rate welding processes are desirable. Robotic welding itself is very commonly employed for structural steel and aluminum applications, but the state of commercialization as this technology applies to titanium is in its infancy. There are many reasons for this, the most obvious is the industries that currently weld titanium are satisfied with the status quo, and the technological challenges to advance the status quo exceed the industries ability and/or interest to invest in a leap ahead technology. Specifically, off the shelf commercial products which would allow for the automated gas metal arc welding of titanium are not currently available. This is manifested in the fact that no domestic producer of welding power supplies provides the necessary welding algorithms for the gas metal arc pulse welding of titanium. In addition, there is little information in the literature regarding welding parameters or weld performance for gas metal arc welds. Finally, additional issues of weld wire feeding, secondary gas shielding, and appropriate welding torches have not been addressed nor are necessarily directly transferable from steel and aluminum to titanium.

Therefore, in order to accomplish the goal of creating a robotic workcell for the welding of titanium receivers, a number of welding issues needed to be addressed, to include: development of titanium GMAW-P welding parameters, torch gas and secondary gas shielding issues, and wire feeding issues. The design of the titanium receiver uses slot and tang in slot types welds. Welds were grouped into three representative categories for weld process development, based upon unique weld joint geometries. Once welds were grouped, welding parameters were established for each weld type. The process of developing parameters began first with trading off wire diameter—0.035” or 0.045”—in bead on plate and test slot welds. After some exploratory work, 0.035” wire was selected for full weld parameter development. Weld parameters were first developed using bead on plate in order to establish acceptable arc conditions and weld penetration. Once an acceptable arc was established, test welds were performed in test slot configurations, measuring 25 mm long, with a 3mm root opening, and 45 degree chamber in 3mm plate. Metallographic testing was performed to assess weld penetration and sidewall fusion. Once parameters were established, these were used to weld 2 prototype weapons having exact weld geometries of the actual receiver.

Lincoln Electric’s WaveDesigner Software (figure 3) was used in the weld parameter development and was used to address welding parameters in the Lincoln Power Wave 455R welding power supply. Welding was accomplished using the Lincoln Electric 120iLT Gantry-mounted robotic welding system (figure 4), modified to include a Binzel push/pull wire feed system, rotary wire straightener, and Linde ST-12 welding torch. Backing inert gas shielding was provided for welds where accessible.

In addition to metallurgical analysis of the welds, the welds were subjected to chemical analysis for interstitial composition. Analysis for oxygen, nitrogen, hydrogen, and carbon was conducted to assess adequacy of shielding gas coverage. Weld metal analysis indicated that interstitial element composition was below that of the base metal.

Initial welding trials indicated wire feeding was inadequate with equipment set-up as supplied by the manufacturer. Originally, no push/pull gun and no wire straightener were used; thus, resulting in a number of wire feed problems, particularly when using 0.035” diameter welding wire. The original torch supplied by Binzel also determined to provide inadequate torch gas shielding for the welding of titanium. Therefore, a push/pull wire feed system, rotary wire straightener, & Linde ST-12 torch were added to the system. Addition of these features improved wire feeding, presentation of the wire to the weld joint, and overall weld shielding.

Since there are no baseline parameters for the GMAW-P welding of titanium, the goal was to develop functional parameters for the successful welding of prototype weapons for testing. The parameters developed under this program are considered are adequate for such a purpose, but more development is required to create a robust set of parameters for production and for commercialization of this welding technology. At the time of publication of this article, 5 functional weapon prototypes have been welded for firing testing. Weld process optimization will continue with the goal of creating a robust parameter set for production.

For more information please contact Steve Luckowski, US Army ARDEC at (973)724-5752.
Technical Discussion Forum

Just when you thought the ITA web site couldn’t get any better, you discovered the ITA Technical Discussion Forum. The Technical Discussion Forum is an excellent opportunity to educate the general public on titanium. This Forum allows individuals to post questions or seek advice on applications involved with titanium.

The openness and transparency of technical information benefits industry at large, a public forum such as this will only be successful if individuals respond to the posted questions. ITA relies on membership to actively participate in assisting with technical questions. The next few editions of the newsletter will feature the most recent inquiries that need your help.

How do I access the Technical Discussion Forum?
2. Click on the “Technical Support” tab from the navigation bar.
3. Click on Technical Discussion Forum.
4. The discussion forum is divided among many topics and areas of interest. Pick your area of expertise and enter your response.
5. Or, go to the bottom of the screen and click on “Getting Started”. This is a basic tutorial.

How do I respond to a question?
1. Click on the question.
2. In the “Add a Message” box, write your comments (No password is necessary).
3. Then click on the Preview/Post Message button.

Why should I participate?
ITA relies on membership to actively participate in assisting with technical questions. With the Technical Discussion Forum, you can check in and respond at your leisure. That is the beauty of this program! You never know what potential customer contacts you may find by answering the posted inquiries.

The Association is designed to educate people on titanium. Your participation in this program is greatly appreciated.

Recent Inquiries - Do you have a comment?

Corrosion:
1. Does anyone have experience with using titanium in de-ionized water? I am looking to use this material for threaded nuts.

Laser Welding Titanium:
What are the best methods for eliminating discoloration on weld seams when laser welding titanium. Welding takes place in a controlled environment of Argon Helium gas and levels of moisture are as low as 10 ppm. I would appreciate ideas on how to eliminate this discoloration.

Heat Treatments:
1. What is the melting point of Titanium?
2. I have been experiencing difficulty in obtaining information on the topic of hardening titanium alloys. Would greatly appreciate thoughts on type of titanium alloys in sheet form and process to harden the titanium alloy once the machining and forming is completed.

Scrape Plates
Which grade of titanium would be best for blocks that would be attached to low points on an automotive vehicles frame to produce sparks when contact with the road surface occurs? I’ve noticed 2 different grades listed when I have found blocks to buy: CP 6-4. Which grade would be best suited to produce a high volume of bright sparks, cool off the quickest, and resist wear to hold up the longest?

CP Surfaces:
1. What is the melting temperature of Titanium grade 5?
2. I am looking for a method to repair surface nicks, dings and scratches on critical, final machined surfaces of commercially pure Ti parts. This would include repair of small scratches on o-ring seating surfaces, etc.

Special Note For The Frequent Traveler… The bulletin board is traveler friendly! For those often on the road, you may check the bulletin board by viewing the topics for a day or week. An overall view of issues can be found by utilizing the tree view icon.
18th Annual Conference & Exhibition
Orlando, Florida USA
October 6—8, 2002

The 18th Annual Conference & Exhibition will be held October 6-8, 2002 in Orlando, Florida at the luxurious Royal Pacific Resort at Universal Properties. The Conference will serve as a gathering for hundreds of titanium related professionals. All facets of the titanium industry will be represented, providing an unprecedented opportunity for networking with both existing and new colleagues. Delegates will stay current on issues essential to successful titanium practices as well as gain valuable insight through exchanging experiences with your colleagues.

In addition to the conference, delegates will have the opportunity to participate in the 8th Annual Golf Classic held at the notorious Panther Lake Course at the Orange County National Golf Center.

The ITA Conference has something to offer everyone. So whether you’re new to the titanium industry or a seasoned veteran in the field, ITA delivers quality resources for your organization. We hope you will be part of this event.

8th Annual Golf Classic

The 8th Annual Golf Classic will occur on Sunday, October 6, 2002 at the Panther Lake golf course at the Orange County National Golf Center and Lodge (ONC). Panther Lake, named on of Golf Magazine’s Top 10 You Can play in the US in 1997 and more recently awarded 4 ½ stars in Golf Digest’s for “Best Places To Play” 2000-2001. This 925-acre ONC is home of the world renowned Phil Ritson Golf Institute, and is one of the most comprehensive and quality oriented golf facilities in the world. In addition to unparalleled golf, it provides a convenient, undisturbed natural setting for meetings, conferences and retreats. You can not compare the Panther Lake Course with any other public golf facility. You truly must experience it for yourself! The 8th Annual Golf Classic is limited to the first 100 golfers.

Reservations are on a first come first serve basis. The cost per golfer is $150. You may register online at www.titanium.org (Click the conference icon from the navigation bar).

Sponsorship Opportunities

Why be a Sponsor at the ITA’s 18th Annual Conference and Exhibition? That’s easy! Here are three reasons to consider…

1. Sponsorship builds credibility and assures your company’s high profile.

2. Corporate sponsorships are good business. Increase your company’s visibility in the market and increase sales of your company's products and/or services.

3. Sponsorships generate publicity for your organization. Have your company's name, logo and message in every registration packet prior to and at the conference.

By sponsoring ITA events you can receive the proper amount of publicity since ITA publishes every sponsor’s name and logo in all conference & exhibition literature, registration materials, and on the ITA website. This is your chance to host your choice of “Conference Events” in which all attendees and guests participate!

The ITA provides sponsorship opportunities throughout the 18th Annual Conference & Exhibition. Visit the sponsorship selections in the conference section of the ITA web site at www.titanium.org.
18th Annual Conference & Exhibition

Exhibition Information

Some of the world’s top suppliers and manufacturers will display the latest products and technologies at the ITA Exhibition. Present your organization by sponsoring an exhibit booth where you can present products, applications, or literature for delegates. The exhibit hall is an excellent opportunity for delegates to gather and network. It also hosts many of the ITA events such as breaks, luncheons and receptions. In addition, ITA hosts an interactive exhibition prize contest, designed to encourage delegates to visit every exhibitor booth. Spaces are limited. Reservations are accepted on a first come first serve basis.

Exhibit Space Rates:

Early registration rates/ before 4/1/02

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Registration rates after 4/2/02

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<tr>
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<tr>
<td>20x20 booth</td>
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Please note that booth space cannot be manipulated into different sizes until after April 3, 2002.

Call For Papers

ITA invites authors to submit a 300 word or one-page abstract of a topic of interest to a broad audience in your area of expertise related to the titanium industry. ITA will focus specifically on the technical themes provided by our members. We encourage you to contribute as well as contact your colleagues who will have something special to offer to this event.

The ITA Speaker Committee will review all submitted abstracts carefully. Relevance, timeliness, and quality are the key factors in the reviewing process.

Speakers are required to register for the conference and pay the appropriate fee before May 15, 2002. Authors wishing to present further papers will have an additional administrative fee of $100 per paper. Please include the estimated length of your presentation.

Royal Pacific Resort

At the Royal Pacific Resort, you’ll feel as if you’ve sailed away to a tropical island paradise. Guests will be able to step outside their room and find themselves in the midst of the world’s most exciting attractions and entertainment, including Universal Studios Florida Islands of Adventure Theme Park and the Universal City Walk® Orlando entertainment complex. This 1,000-guestroom luxury property will captivate guests with its elaborate landscaping, waterfalls and lagoons. With its unique design and exotic charm, you will feel transported to the enchanted isles of the South Pacific.

Room Rates:
Single $158 / Double $158

For room reservations:
Contact the Resort directly at: (888) 837-2273 press option 2, or visit the conference section of the ITA web site at www.titanium.org. Remember to tell them to place you under the International Titanium Association Room Block to receive the discounted room rate.

Wish to extend your trip...
The Royal Pacific Resort has offered the discounted room rate to all ITA delegates from October 3rd thru October 11th.
# 18th ANNUAL TITANIUM CONFERENCE REGISTRATION
Orlando, Florida  October 6 – October 8, 2002

**Pre-Registration Cut-Off:**  September 16, 2002

Your receipt and attendance confirmation will be mailed to you once the ITA has processed your registration.

Please Type or Print in Black Ink Only.

Today’s Date:  

First Name:  

Last Name:  

Title:  

Organization:  

Mailing Address  

City:  
State:  
Zip:  
Country:  

Telephone:  
Facsimile:  

E-mail:  
Spouse’s Name:  

Badge Name:  

REGISTRATION FEES: Conference Registration includes:  All scheduled ITA functions, entrance to Exhibition, Breakfast, Lunch, and all sponsored receptions.  Attendees will also be mailed Conference Proceedings.  Spouse registration includes entrance to Feng Shui Presentation, evening receptions, and gala event on Tuesday evening.

<table>
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<tr>
<th>Before September 16th</th>
<th>After September 16th</th>
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<tr>
<td>$595 ITA Members</td>
<td>$795 ITA Members</td>
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<td>$795 Non-Members</td>
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*Academic is any individual currently employed full time by an education institution.  (Must include a valid copy of employee ID with registration).

For Men:  

- 2002 Conference Embroidered Polo Shirt:  
  - Color:  
  - Size:  

For Women:  

- 2002 Conference Baseball Cap:  
  - Color:  

SPECIAL EVENTS:  

- 8th Annual ITA Golf Classic:  
  - Sunday, October 6th, 7 a.m. – 1 p.m.  (Shotgun Start)  
  - $150 per golfer  
  - Tournament is limited to 100 participants.  Eligibility will be based on your registration date.

- Feng Shui Presentation:  
  - Monday, October 7th, 1 p.m. – 5 p.m.  
  - $60  
  - Presented with spouse registration-RSVP not required

- The Fundamentals of Titanium 101*:  
  - Wednesday, October 9th, 9 a.m.– 5 p.m.  
  - $195.00 each

**METHOD OF PAYMENT:** (Prepayment Required)

**Paying by Credit Card?**  Select one  

- Note: Only MasterCard or Visa Accepted

- Credit Card Number:  
  -  

- Name Exactly as Appears on Card:  

- Expiration Date:  

- Authorized Signature

**CANCELLATION POLICY:** A $15 Processing fee will be charged on all cancellations.  

- Cancellations received in writing before August 19th will receive 75% Refund.  Cancellations received in writing before September 16th will receive 50% Refund.  No Refunds will be provided after September 16th.

**SPECIAL NEEDS:**  

- In compliance with ADA regulations, please notify ITA if you require any special assistance or have restricted dietary needs.

**QUESTIONS?**  

Visit www.titanium.org or contact 303-404-2221

**PAYING BY CHECK?**  

Be sure that your check is in U.S. currency drawn from a U.S. Banking Institution, payable to the International Titanium Association.  Include a printed copy of this completed form with your check and mail to:  

ITA, 350 Interlocken Blvd., Suite 390, Broomfield, CO 80021

**PAYING BY ELECTRONIC WIRE?**

Banking Institution:  

Colorado Business Bank,  
821 Seventeenth St., Denver, CO 80202 USA

Telephone Number:  

1-303-413-6000

ABA Routing Number:  

102003206

Credit: International Titanium Assoc.  

Account 4006769

Must include $25 U.S. Wire Fee

**MAIL COMPLETED FORM TO:** International Titanium Assoc.,  
350 Interlocken Blvd., #390, Broomfield, CO 80021-3485 USA

**FAX COMPLETED FORM TO:** International Titanium Assoc. (303) 404-9111
HOTEL REGISTRATION FORM
Loews - Royal Pacific Resort
1000 Universal Studios Plaza
Orlando, FL 32819 USA
Telephone: 888-837-2273 press option 2
Facsimile: 407-503-1191

This reservation form, along with one night’s deposit, must be received no later than September 12, 2002

NAME: ____________________________  SHARE WITH ____________________________
HOME ADDRESS: ____________________________
CITY: ____________________________  STATE: ____________________________  ZIP: ____________________________
HOME PHONE: ( ) ____________________________
COMPANY NAME: ____________________________
COMPANY ADDRESS: ____________________________
CITY: ____________________________  STATE: ____________________________  ZIP: ____________________________
BUSINESS PHONE: ( ) ____________________________  FAX NUMBER: ( ) ____________________________

Reservation Request:

Standard: Number of Rooms________ Single Occupancy________ Double Occupancy________
Suites: Please telephone the Royal Pacific Resort for availability.

Arrival Date____________  Departure Date____________  Expected Arrival Time______AM/PM

Guest Room Rates for the ITA Annual Titanium Conference:

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<tr>
<th>Type of Room</th>
<th>Room Rates:</th>
<th>In U.S. Dollars</th>
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<td>Standard:</td>
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<td>$158</td>
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<tr>
<td></td>
<td>Double:</td>
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NOTE: Reservations will not be held after 30 days without a deposit. Credit cards will be charged a one night deposit upon receipt. Reservations must be cancelled three (3) days or 72 hours prior to arrival to avoid forfeiture of deposit. Group rates, rooms and dates are subject to availability.

Enclosed is my one night’s deposit payable by: (Please check one) Check Credit Card

Credit Card Information:

Type:  Discover  American Express  Diner’s Club  Carte Blanche  Visa  MasterCard

Name (exactly as appears on credit card)__________________________________________

Card Number____ /____ /____ /____ - /____ /____ /____ - /____ /____ /____ - /____ /____ /____ - /____ /____ /____ Expiration____ /____

Authorized Signature___________________________________________________________

PLEASE RETURN THIS COMPLETED FORM TO:
Loews - Royal Pacific Resort
1000 Universal Studios Plaza
Orlando, FL 32819 USA
Fax: 407-503-1191
2003 Conference

In the heart of Old Monterey, just steps from Fisherman's Wharf, there is a resort hotel with service that is as memorable as the view - the Double Tree Hotel. The International Titanium Association invites you to participate in the 19th Annual Conference & Exhibition at the Double Tree Hotel in Monterey, California on October 12-14, 2003.

Exhibition reservations and sponsorship opportunities are now available. Contact Stacey Jorgensen at (303) 404-2221 or visit the conference section of the ITA web site today for more information.
Founded in 1984 the International Titanium Association is a nonprofit networking trade association for the titanium industry. The primary focus of the Association is to promote the continued growth of the industry as well as educate the public on benefits and implementation of using titanium. Current membership includes 106 organizations.

<table>
<thead>
<tr>
<th>Current Membership</th>
<th>Includes the Following Companies</th>
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<tr>
<td>Affinity International, LLC</td>
<td>Pacific Cast Technologies, Inc.</td>
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<td>Airport Metals</td>
<td>Pacific Titanium, Inc.</td>
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<td>Perryman Company</td>
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<td>Allegheny-Ludlum</td>
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<td>Allvac</td>
<td>Plymouth Tube Company</td>
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<td>Wah Chang</td>
<td>Poggipolini SRL</td>
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<td>President Company, Ltd.</td>
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<td>Remmele Engineering Inc.</td>
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<td>Rome Metals Inc.</td>
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<td>RTI International Metals Inc.</td>
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<td>CK Worldwide Incorporated</td>
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<td>Coastcast Corporation</td>
<td>Sandvik Special Metals Corporation—Sweden</td>
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<td>Sumitomo Corporation of America</td>
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<td>Sumitomo Sitix of Amagasaki Incorporated</td>
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<td>Supra Alloys Incorporated</td>
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