

Chevrolet Corvette Continued

TIMET developed a special conditioning process to provide a surface condition that speeds forming rates and minimizes production losses. In addition, to meet GM performance requirements, Arvin redesigned individual muffler components due to physical differences such as vibration & resonance frequency between stainless steel and titanium.

[Reaching the Ten-Year Life Goal](#)



Besides weight reduction, corrosion resistance is the central benefit of the titanium exhaust system. Titanium's natural oxide layer provides virtual immunity to corrosion from road salts, as well as sulfur-rich engine exhaust gases. In a production vehicle, the system will far outlast anything made of stainless steel, resulting in fewer warranty claims.

According to TIMET, "there is nothing we can find in tests conducted over a number of years that will cause corrosion failure; not the sulfur in the fuels, salts or other contaminants from road exposure. Nothing." So far, titanium exhaust systems appear to be immune to any corrosion in the automotive environment. Thus, the expected EPA warranty requirement of 10 years for entire exhaust systems (all materials from the engine to tail pipe tip) is easily achievable.

More than likely, the titanium exhaust system will outlast the car. By comparison, stainless steel exhaust systems have a typical life cycle ranging from 5 to 10 years depending on the use environment, which means customers who keep their cars for more than 7 years and purchasers of used cars are likely to encounter replacement expenses. Corrosion of stainless steel exhaust systems can occur at hot spots, but the most likely failures take place at the weld joints of system parts. This happens because the weld metal and its associated heat affected zone (HAZ) have different chemical compositions and metallic structures, which will set up corrosion conditions that limit life. Welding titanium, on the other hand, causes no changes in metallic structure or chemistry so the HAZ offers the same corrosion resistance as the base metal.

Titanium also has exceptional resistance to mechanical damage. Basically, titanium has a much higher capacity to absorb energy from impacts than stainless steel. Although this is a technically complicated issue, a major contributing factor is titanium's lower modulus of elasticity compared to steel. This lower modulus helps titanium to rebound from impact, so it has higher resistance to stone damage and mechanical shock. In fact, because of its exceptional strength and impact resistance, titanium is the low-cost choice for

lightweight, bullet resistant and ballistic armor for the U.S. military. The military made this choice after extensive ballistic testing with titanium. Thus, titanium exhaust systems have a vastly improved service life expectancy compared to stainless steel because of superior corrosion resistance and mechanical durability.

[Titanium Exhaust Systems – Performance and Cost](#)

For the Corvette Z06, the titanium exhaust system's light weight increases the car's horsepower-to-weight ratio. In fact, the titanium exhaust system on the Z06 is the single largest contributor to weight reduction from the previous year's hard top model. Titanium saved 18 pounds on the Z06, a big step towards the car's weight reduction goal of 160 pounds over the standard model.

In spite of the weight and corrosion advantages, most automotive engineers will bring up the question of cost. Popular opinion says titanium is too expensive for a volume production car. In fact, the titanium system does cost more than the alternative stainless steel units on conventional Corvettes, however, Arvin and TIMET demonstrated production cost goals can be met for the auto industry.

Basically, the key to lower titanium costs for automobiles is that the metal can be rolled, formed and fabricated on available high-volume steel production equipment. Expensive new equipment specifically designed for titanium is not required. What *is* required is special tooling and the knowledge of titanium's own fabricating characteristics.



The Corvette application of a titanium exhaust system demonstrates that for selected car models, titanium is already at a price level where the benefits outweigh its price premium. Moreover, as volume production increases, price premiums will become progressively less. Titanium is at a point in its history where its prices are more and more volume dependent. It sits at a classic crossroad. In order to lower prices to meet volume automotive production requirements, volume production facilities are required. In order to pay for the high volume production facilities, volume automotive orders are required.

The reality is many high production facilities for producing titanium already are in existence. As an example, industrial grades of titanium cost less than half of

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Chevrolet Corvette Continued

aerospace grades costs and are in wide use in chemical processing, sports and marine equipment, off-shore drilling equipment and steam condensers for power generation. The cost difference is due in large measure to continually increasing availability of higher volume production facilities for titanium.

High Volume Melting a Major Factor

TIMET will not disclose the price of the titanium exhaust grade it developed for automotive applications, but did indicate how volume production can reduce prices. The exhaust grade is a version of commercially pure titanium similar to industrial Grade 2. It is produced at the Morgantown, PA facility, which includes 3 of the world's largest titanium electron beam (EB) melting furnaces. The furnace size is a major cost reduction step. The furnace produces 64-inch wide slabs of titanium in a manner similar to continuous casting. Starting with such a large slab permits fewer rolling steps on larger rolling equipment resulting in lower production costs. The EB furnace also uses a large percentage of titanium scrap which further lowers costs compared to only using titanium sponge. Running this large equipment in continuous production is only possible with high volume requirements such as exhaust systems or other automotive applications.

TIMET says the price differences can be dramatic. Aerospace grade commercially pure titanium flat rolled product costs about \$18 per pound. Industrial grades range from about \$7.50 to \$10 per pound. Exhaust grade, though more costly than stainless steel, is in a price range where it is competitive when performance advantages are included in the evaluation. To conclude, TIMET insists price comparisons must be made based on volume, not mass. Because titanium's mass is slightly more than half of stainless steel, for equal volume or equal strength, the price for the equivalent titanium is half the reported per pound price when compared to stainless steel.

The Future of Titanium Exhaust Systems

At first glance it seems titanium at its present *TIMETAL*® Exhaust Grade price may be limited to high performance cars, such as the Z06. However, titanium exhaust systems can bring immediate benefits to other car models as well, particularly those needing improved performance, better fuel economy and longer component life. In fact, TIMET reports titanium exhaust components tests on such car models are underway around



the world. Compelling reasons for this include titanium exhaust systems

provide the single largest “bolt on” weight savings, without crash or other testing, of any component on a car. A car with CAFE or gas guzzler tax problems that is over prescribed weight limits because of consumer desired (and profitable) options, can bolt on a titanium exhaust system & stay within its weight class. Longevity is another benefit. Today's stainless steel exhausts simply will not last as long as a growing number of consumers would like. “High-end” brands are increasingly offering dealer-certified used cars to sway buyers into their brands. The desire for longer-life customer satisfaction is increasing a manufacturer's need to increase exhaust life expectancy as it is unacceptable for a used car buyer to be forced into a costly exhaust system replacement soon after purchasing a dealer-certified used car. Other reasons include expected government regulations extending auto manufacturer warranty to the tip of the tail pipe; plus, maintaining a best-quality reputation.



Another advantage of titanium exhausts is the overall reduction of vehicle mass improves handling qualities affording more nimble characteristics. Greater weight reductions are possible with titanium exhaust systems on conventional passenger cars than on racing bred cars such as the Z06. This is a technical issue related to the high heat generated in racing. A close look at the Z06 exhaust system reveals the point.

Titanium saves 41% in weight versus stainless steel on the Z06 Corvette, but it replaced the stainless steel design nearly gauge for gauge. The essentially direct gauge exchange was required because of hot exhaust gases (1200°F) generated during race track exposure. More weight savings are possible with conventional road cars since they do not generate as much exhaust heat. Auto designers can take even greater advantage of the corrosion resistance of titanium. Titanium does not require corrosion allowances in exhaust systems, a practice common with stainless steel & other metals leading to use of thicker gauges than required for structural reasons. At thinner gauges, titanium exhaust systems in conventional cars provide a weight savings as high as 55%-60%. Savings that can take as much as 35-40 pounds out of a large car; a car that may be on the upper edge of its CAFE weight class.

TIMET believes titanium's technical advantages, along with lower production costs, will lead to increasing use. The company expects exhaust systems to lead the way. “We think high volume titanium applications in the auto industry will come sooner than most people expect,” Mr. Faller concluded.

For more information contact: Kurt Faller, 610-286-1222, kurt.faller@timet.com

Titanium Achievement Award

2000



Stanley Abkowitz
President, CEO
Dynamet Technology Inc.

On Tuesday, October 10, 2000 ITA will proudly present Stanley Abkowitz, President and CEO of Dynamet Technology Inc. Burlington, Massachusetts, with the “Titanium Achievement Award” for his outstanding career achievements.

Mr. Abkowitz has pioneered several approaches toward the titanium component manufacture. During the past year and in recent years Mr. Abkowitz has greatly contributed to the titanium industry. These contributions include the development of the Ti-6Al-4V alloy at the Army, his authorship of the first book on titanium, “Titanium In Industry” published by Van Nostrand, his development of several commercial alloys at RMI Company and his innovative titanium powder manufacture at Nuclear Metals Inc. (now Starmet). These contributions were followed by his pioneering titanium powder metal component manufacturing technology at Dynamet Technology (which he founded) along with his development of titanium matrix composite compositions of proven practical significance.

Mr. Abkowitz is an expert on high temperature aerospace materials. He graduated from Massachusetts Institute of Technology in 1948 with an S.B. degree in chemical engineering. He has 20 patents and has authored more than 50 publications on titanium, superalloys and other advanced materials. We are privileged to have Mr. Abkowitz as a long time member of the ITA.

Inside ITA

On-Line Registration Wins Out

ITA is pleased to announce that the Annual Titanium Conference & Exhibition in New Orleans, October 8-11, 2000 has exceeded attendance expectations.

With the new on-line registration available this year on the ITA Web Site, ITA has experienced a great volume of attendees registering early where in prior years, the majority of attendees signed up in September. As of September 1st, ITA had filled the targeted projection number for conference registrations and therefore the hotel obligations by the ITA had been met. This is why some attendees who registered after August 25th may have experienced unavailability with the Hilton New Orleans Riverside.

The majority of the New Orleans conference registrations were received through visits to the ITA Web Site - over 60% in fact! The breakout of conference demographics concludes:

Attendance Registrations

	Internet Registration (On Line Registration & Download Registration)
180	65.2%
27	9.8%
21	7.6%
16	5.8%
12	4.3%
10	3.6%
8	2.9%
2	0.7%
276	100.0%

Total Registrants as of 9/22/00

Conference Registration Members vs Non Members

ITA Members:	Count:	Non Members:	Count:
March, 2000	2	March, 2000	0
April, 2000	17	April, 2000	2
May, 2000	5	May, 2000	0
June, 2000	8	June, 2000	8
July, 2000	15	July, 2000	4
August, 2000	80	August, 2000	51
September, 2000	40	September, 2000	44
Sub Total:	167	Sub Total:	109

Total Attendees as of 9/22/00: 276

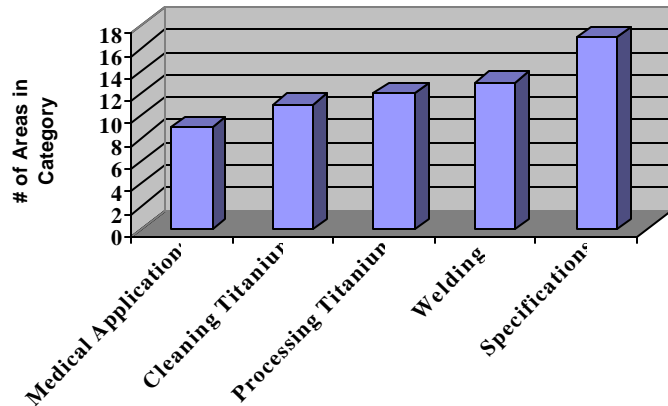
Bulletin Board Educates Public

The ITA Technical Discussion Forum is an online bulletin board that encourages open-ended discussions of technical issues related to the titanium industry. This month ITA has had over 120 visits to the Technical Discussion Forum. Topics on the forum include:

Anodizing Titanium	Polishing Titanium
Brazing	Processing Titanium
Cleaning Titanium	Safety
Corrosion	Specifications
Cutting	Statistics
Diffusion Bonding	Temperature & Pressure Rates
Forging Titanium	Titanium Bluing Under Heat
Marine Applications	Titanium Jewelry
Medical Applications	Titanium Reaction to Metals
Welding	
Laser & Electron Beam Treatment	

To explore the bulletin board simply go to the ITA website at www.titanium.org and select the technical support category.

Top 5 Discussion Areas



ITA Web Statistics Month of September 2000

2,500 visits to the ITA website

400 visits to the ITA Conference Section

180 visits indicated the conference registration packet had been downloaded

120 visits to the Technical Discussion Forum

New ITA Members

ITA is pleased to welcome the following organizations as new members:

Spectore Titanium Corp



Spectore Titanium Corp. was formed in March, 1983. Spectore manufactures and develops the metals titanium, niobium, and tantalum into exciting products for the jewelry, gift, and other markets where the unique advantages of these metals (lightweight, hypo-allergenic, refractory, durable) could best meet consumer needs. The product's primary uniqueness lies in the color achieved through specially developed treatments of the metals' surface.

Spectore has demonstrated revolutionary products and manufacturing techniques to retailers in the world market. Many of its designs are a direct result of company developmental technologies. The company has won international awards, and has been exhibited in the British museum, Goldsmith's Hall, Museum of Ireland, and the Smithsonian Institute. Spectore Corporation is the innovator and world leader in aesthetic refractory metal technology. For more information visit Spectore on the internet at www.spectore.com.

Rome Metals Incorporated



The equipment and personnel of three facilities, located in Monaca, Zelienople, Rochester, PA enable Rome Metals Inc. to process virtually anything from ingots to finished products. Rome Metals Inc. has the ability to handle not only large pieces, but high volume as well. In fact, nearly eight million pounds of specialty metals pass through their facilities every month. Rome Metals routinely processes special materials such as titanium, zirconium, nickel, and cobalt-based superalloys - with excellent results every time.

Rome Metals' success in the market is proof that specialization does not limit capabilities. They perform all kinds of metal finishing operations on virtually any kind of metal, including:

- Precision grinding and polishing
- Abrasive and bandsaw cutting
- Shearing, Grit Blasting, Cleaning
- Ultrasonic and dye penetrant testing
- VCF Vacuum Creep Flattening

For more information, visit Rome Metals on the internet at www.romemetals.com.

Find a complete Member Profile of all ITA member companies by visiting the Buyer's Guide On Line at www.titanium.org.

Corrosion Materials



Corrosion Materials is a 30 year old company, specializing in the distribution of corrosion resistant alloys. They carry 15 nickel based alloys in all product forms. These would be the hastelloys, monels, nconels and the like. Corrosion Materials has begun stocking grade 2 titanium in 2000 to service the chemical process industry, which is their main focus on the other alloys. They have been ISO 9002 certified since 1993 and have sixteen machinists and four welders for the manufacture of special parts and fittings. Corrosion Materials is headquartered in Baker, LA, which is on the north side of Baton Rouge. There is also a branch in Houston, Texas. Distribution is worldwide though a system of agents and through offices in England and Beijing, China. For more information visit Corrosion Materials on the internet at www.cormatls.com.

Titanium Sports Technologies, LLC



Titanium Sports Technologies is the nation's leading producer of high-quality, seamless titanium tubing products for the sports industry. The company specializes in titanium golf shafts, fishing poles, high-performance bicycle and motorcycle frames, and shaped and formed tubing and fabricated parts. One division, Ti Sport, manufactures and markets complete, "custom produced to users specification", titanium sports wheel chairs. Titanium Sports Technologies strives to produce the finest titanium frames in the world with uncompromising standards for weld quality and frame alignment.

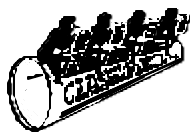
TST, the newest division of Titanium Sports Technologies, was formed to sell high quality titanium and titanium alloy seamless tubing for sports & commercial applications, and fabricated and shaped tubing assemblies.

Titanium Sports Technologies is located in Kennewick, WA. For more information, visit Titanium Sports on the internet at www.titaniumsports.com.



ITA Classified Ads

ITA On-line Classified Ads



ITA members rely on the ITA website for the latest news & upcoming events. Now both members and non-members can actively participate with classified advertising. No other website reaches more qualified personnel for titanium related operations than ITA.

Target this specialized market by advertising your Equipment, Materials, Products or Business Opportunities you are in search of or have offered for sale in the ITA Classifieds. Visit the Classifieds section of the ITA Web Site at www.titanium.org. Simply click on ITA E-News & Classifieds icon from the Home Page.

When you submit a classified ad, ITA will proof your advertisement, process your payment, and post it to the website within 2-3 business days. ITA is not liable for confidentiality in classified advertising at any time and reserves the right to reject any advertising not in compliance with ITA standards.

Fee Schedule:

ITA Members: Free of Charge

Non-Members: \$25.00 for 90-day period. You will be notified via e-mail 3 weeks prior to your ad's expiration date at which time you may renew your classified ad for an additional 90-day period.

Introductory Promotion: An additional 30-days free of charge with a pre-paid \$25.00 classified ad.

Visa and MasterCard are accepted. Should you prefer to pay by check or electronic wire, please contact Info@titanium.org for more information.

Current Ads listed on the site include:

Equipment Wanted:

Laser spot welding equipment.

Name of Company : President Co., Ltd.

Contact Name : Mr. K. T. Fan

Contact Email : presco@ms23.hinet.net

Description : We are looking for the laser spot welding equipment for Titanium welding. Please submit offers to: President Co., Ltd. Tel : 886-2-2741-1190 Fax: 886-2-2741-2378 .

Products For Sale:

580 mT Titanium Wire Ingots For Sale .

Contact Name : Soheil Soheilzadeh

Contact Email : soheils@hotmail.com

Description : About 580 mT Wire Ingots Titanium is available. Detailed information is available upon request.

Products Wanted:

Titanium Chain Fitting for Marine Hardware .

Contact Email : info@mizken.co.jp

Description : We are one of leading importers of hardware in Japan. We would like to have titanium-made chain fitting for marine hardware. Please provide your titanium item's number, photo, export price, m/m qty, delivery at least. Please contact by fax 81-6-6534-6809 or by e-mail.

Titanium Grade 5 Fuel Bottle for Nitrogen Gas .

Contact Email : kibtit@eth.net

Description : Seeking Titanium Grade 5 Fuel Bottle for Nitrogen Gas. Please supply brochure or other information to: Jey Akumar. V Director KJB Titanium Pvt., LTD 30-A, Duraisamy Nagar, East Tambaram, Chennai, India 600059 fax:91 44 2375770.

Business Opportunities:

Seeking Joint Venture Partner for Titanium Extraction & Refinery Plant:

Contact Name : Mr. Tan Lee Kang-Director

Contact Email : rainehorne@pd.jaring.my

Description : International property consultant searching for a joint venture partner for a Titanium extraction & refining plant. For additional information contact: Raine & Horne Intl, 1557, Jalan Kota 05000 Alor Star, Kedah, Malaysia Fax: 604-730878, 7317663

Senior Metallurgist Position Offered.

Contact Name : Eric Rasmussen, President

Contact Email : eric@rpsconsultants.com

Description : Please see details section of ITA classifieds at www.titanium.org for a complete job description and contact information.

ITA Classified Ads Continued

Materials For Sale:

Titanium Ore - Rutile Natural - Product of Nigeria

Name of Company: Jerry Barnes

Contact Name: Macenta Group LLC

Contact Email: jerrybarnes1@Juno.com

Description: The Titanium lot offered and described below by Bureau Veritas report number LAG/9-2000/071 A, dated 6/30/00 is an assay of recently mined material. It is anticipated the TiO₂ in future assays will raise into the 90-percentile range as digging moves further below the surface.

COMMODITY: Titanium

LOCATION: : Lagos, Nigeria

PACKING: Polypropylene Bags

QUANTITY: 386 Bags

TOTAL NET WEIGHT: 19,285,000 KG

PARTICLE SIZE: 1 cm -6 cm randomly

SEAL: Bureau Veritas Seal No.3152

QUALITY FINDINGS:

TiO₂ 81.20% Rutile

Fe₂O₃ 14.26% Imenite*

Nb₂O₅ Not Detectable

Ta₂O₅ Not Detectable

Moisture Content: 0.02%

Radioactivity: 20 counts per second

Please see details section of the ITA Classifieds at www.titanium.org for more information.

Scrap Titanium and Aluminum For Sale .

Contact Name : Fred Nelan

Contact Email : fnelan@aig.com

Description : I have about 40,000 lbs of scrap titanium and 100,000 lbs of aluminum from a plane crash on my ranch. Through a legal settlement with the Air Force the metal is mine. Please Send offers to: 760 Rinconada Ln, El Paso, Texas 79922 Telephone: 915-860-0701 Fax: 915-860-0702 or by Email.

Orthopedic Screws, Plates, etc. .

Name of Company : Texas Dental

Contact Name : Gene Gant

Contact Email : TexasDental@aol.com

Description : Orthopedic screws, plates etc. Some Titanium, Stainless, etc.

Materials For Sale:

Seeking: 600 Tons Titanium.

Name of Company : Douglas Pilsner

Contact Name : Digital Iris Communications-Canada

Contact Email : doug@irisdg.com

Description : 600 Tons Titanium needed for International Client. Please see "Details" below for complete description.

Seeking Manufacturers of 430Ti Alloy.

Name of Company : Everwin (Canada) International Inc.

Contact Name : Fan Jing Hui

Contact Email : everwin.canada@home.com

Description : Seeking Manufacturers of Nickel or Titanium alloy in North America to export to China. Please refer to attachment for detailed technical requirements.

Titanium Plate Foreign Spec/Designation.

Name of Company : Total Alloys

Contact Name : Ed Greenspon

Contact Email : ed-ocmc@pacbell.net

Description : Looking for Titanium Plate foreign Spec/Designation TA-6VAN,ASNA3200 5.00mm THICK+0.2mm-0.6mm X 1092 mm X 2253mm. Need 10 Sheets - can use slightly heavier and different width, length. If you offer, go with square footage.

International Companies that Produce Rutile.

Contact Name : Eng. Ricardo Sabeckis

Contact Email : ricardosabeckis@infovia.com.ar

Description : Seeking international companies that produce titanium dioxide type "rutile", used in painting, paper, plastic and food industries. In Argentina there is a monopoly supply and we are looking for new international sellers. Fax: 54-11 4343-2136

Grade 7/11 Billet, Bar or Ingot - Also Scrap.

Name of Company : Metals Inc.

Contact Name : Mark Kaichen

Contact Email : mkmets@gunnison.com

Description : I want to purchase Grade 7/11 Billet, bar, or ingot & also scrap. Please send offers to my attention at: 24441 Hwy. 149 Powderhorn, CO 81243 Telephone: 970-641-9759 Fax: 970-641-9761

ITA Member Companies

ADMA Products Incorporated
Affinity International, LLC
Airport Metals
Allegheny-Ludlum
Alpha Source Incorporated
AstroCosmos Metallurgical
Bekaert Fibre Technologies
BIBUS Metals AG
Cast Alloys Incorporated
CK Worldwide Incorporated
Coastcast Corporation
Cogne Acciai Speciali S.r.l.
Conexão Sistemas De Prótese
Corrosion Materials
Danco Metal Surfacing
Deutsche Titan GmbH
Dynamet Incorporated
Dynamet Technology Incorporated
Dynamic Machine Works Incorporated
Dynamic Materials Corporation
ELLETT Industries Limited
Excelco Developments Incorporated
F.W. Hempel & Co.
FAE S.A. Fabricación de aleaciones especiales
Flowserve Corporation
Fluortech Ltd.
Fort Wayne Metals Research Products Corp.
General Titanium Incorporated / BIAM
GfE Gesellschaft für Elektrometallurgie mbH
GFI Aerospace
GIB Resources Incorporated
Grandis Metals
Hi Tech Alloys
Howmet Corporation
Hyundai Titanium Company, Ltd.
Itochu Non-Ferrous Materials Company, Ltd.
Jamegy Incorporated
Joseph Oat Corporation
JSC "FIKO"
K.P.C. Corporation
Keywell LLC Vac Air Division
LOTERIOS S.p.A., a TIMET Company
Luxembourg Company of Metals and Alloys S.A.
Metal Management Aerospace, Inc.
Metem Corporation
Monico Alloys Incorporated
Naval Surface Warfare Center
NF & M International Incorporated
Noble Alloy Valve
Non Ferrous International Corp.
Northwest Institute for Nonferrous Metal Research
Pacific Cast Technologies, Inc.
Perryman Company
Northwest Institute for Nonferrous Metal Research
Pacific Cast Technologies, Inc.
Perryman Company
Plymouth Extruded Shapes
Plymouth Tube Company
Poggipolini SRL
Powder Alloy Corporation
President Company, Ltd.
President Titanium Incorporated
Reading Alloys Incorporated
Remmele Engineering Inc.
Retech Services, Inc.
RMF Refractory Metals Division
Rome Metals Inc.
RTI International Metals Inc.
Sandvik Special Metals Corporation
Siderval S.p.A.
Solar Atmospheres Incorporated
Spectore Corporation
Spemet Company, Ltd.
STADCO
Strohecker Incorporated
Sumitomo Corporation of America
Sumitomo Sitix of Amagasaki Incorporated
Supra Alloys Incorporated
TechSpec Incorporated
TERRA 4 Titanium Incorporated
Tibrasil Titanio Ltda.
TICO Titanium Incorporated
TIMET
TIODIZE Company, Inc.
TiSurf International AB
Titania S.p.A.
Titanium Engineers Incorporated
Titanium Fabrication Corporation
Titanium International Fabricators (Pty) Limited
Titanium Products Incorporated
Titanium Sports Technologies LLC
Trans World Alloys Company
Tricor Metals
U.S. Chrome Corporation of California
U.S. Vanadium Corporation
Ulbrich Stainless Steels & Special Metals, Inc.
United Titanium Incorporated
UTSC c/o Toho Titanium Company, Ltd.
Vac-Hyd, A Division of Lindberg Heat Treating Co.
VALTIMET
VSMPO
Vulcanium Corporation
Wah Chang
Western Titanium Incorporated
Zirconium Research Corporation