

# The Corrosion Chronicle



Spring 2011

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## Where you can see the Ashland corrosion team

CoalGen Columbus, OH  
Aug. 17 - 19, 2011

AIMEX – Asia Pacific International Mining Exhibition Sydney, Australia  
Sept. 6 - 9, 2011



## FRP Has Rich Future in Mineral Processing

Mining activity in a number of basic metals and minerals has been running quite high over the last few years. Historically high commodity prices for metals and minerals spurred on by rapidly rising worldwide demand for raw materials are heating up both organic growth projects and merger and acquisition activity. The world needs resources to meet explosive growth in developing nations and to supply the ongoing high level of demand in developed nations.

As emerging markets like China and India continue to industrialize and urbanize, this upward trend is expected to continue and accelerate. According to Rio Tinto CEO, Tom Albanese, quoted at the firm's annual meeting last April, "There is a growing population around the world that wants to improve their standard of living. They want better housing, cars, infrastructure, washing machines and mobile

phones. Over the next 30 years, it is projected that the world will consume as much copper as it has over the last 10,000 years."

Vince Matthews, Director of the Colorado Geological Society went further in his keynote remarks to the Society for Mining Metallurgy and Exploration (SME) last March, "Years of dramatic economic and population growth in China have transformed the global economy. In 2005, China opened 70,000 supermarkets. Think of all the steel you would need to build 70,000 supermarkets. In 2006, China became the world's third largest national car manufacturer. In 2008, it became the world's number two car market. The next year, it became the world's largest car market **and** the world's largest car manufacturer. It is now the world's largest car exporter, the world's second largest economy,

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## Mineral Processing

continued

and the world's largest creditor." Seeming to confirm these observations, the China National Bureau of Statistics reported GDP growth rate in the first quarter of 2011 at nearly 10%.

People throughout the BRIC (Brazil, Russia, India and China) countries are trading in their bicycles for BMW's. Millions of people are abandoning rural areas and flocking to urban centers. The ensuing dramatic infrastructure changes and economic growth are rapidly increasing demand for, and pricing of, many minerals globally.

Newmont Mining Corporation Executive VP and CFO, Russell Ball predicts, "By 2030, China's urban areas will increase by over 300 million people, and by 2025 China will use more copper in one year than the whole world produces today." Ball further predicts a global copper deficit will occur by the year 2013. Colorado Geographical Society's Matthews added that China imports more than 82% of its copper today, which has helped drive up copper prices by more than 450% since 2003. Copper now fetches about \$4.50 per pound in global markets, up from about 65 cents per pound in 2003. In fact, prices for a wide variety of metals and minerals have soared over the last two years.

India is following the same exhilarating trend. Metals demand in India, Asia's second fastest growing major economy, is expected to double in the next five years and remain robust for more than a decade, fueled by rising car sales and higher spending on infrastructure projects. Prime Minister Manmohan Singh has proposed US\$1 trillion of spending in the next five years through 2017 to upgrade India's road, railway and power networks. The government's statistics office reported in April that India's economy will probably grow 8.75% - 9.00% in 2011, the most in three years.

According to Barclays Capital, commodity demand in India has reached a "tipping point" where the nation may surpass the US as the second largest consumer of copper, aluminum and zinc by the early 2020's. "Growth in demand for base metals may jump 10 - 15% this year", says Analyst Sumit Verma at Geojit Comtrade Ltd. That compares with an average increase of 6% for aluminum and copper, and 4.3% for zinc between 1972 and 2009 according to Barclays, who went on further to predict that base metals demand would jump 80% by 2015.



Cajamarquilla Sulfuric Acid Plant Made with Extensive Use of FRP

### Metal Demand Drives New Mining Projects

The world's largest nickel mine – the massive \$4.76 billion Ambatovy nickel mine on the African island nation of Madagascar is nearing completion. When it reaches its full production capacity in 2013, the mine will produce 60,000 MT/yr of nickel and 5600 MT/yr of cobalt. It will also include a sulfuric acid plant. Coming on the heels of the Ambatovy project is the Long Harbour Processing Plant in Newfoundland, Canada which will process the ore from Vale's Voisey Bay mine in Labrador. Voisey's Bay is expected to generate more than 50,000 MT/yr of nickel ore when it starts up in 2013. Overall, Vale S.A. is expected to spend more than \$26 billion during the next two years to complete projects currently under construction.

Next up will be Baja Mining's Boleo project in Mexico on the Baja peninsula. When commissioned in 2013, the \$US 858 Million Boleo project is expected to produce 60,000 MT/yr copper, 3100 MT/yr cobalt, 36,000 MT/yr zinc and 100,000 – 250,000 MT/yr manganese carbonate.

### FRP Delivers Unmatched Value in Mineral Processing Environments

FRP based upon Derakane™ and Hetron™ epoxy vinyl ester resins have been used for decades in the design of corrosion resistant equipment for mineral processing environments. These materials routinely outperform stainless steel and rubber lined steel for both durability and cost. Moreover, the same global trends that are driving interest in nickel production are also driving up the price of stainless steel and higher nickel alloys. These specialty metals are often hard to come by resulting in long lead times for delivery. Rubber lined steel is a bit more affordable but requires continuing maintenance over time which ultimately drives up its cost considerably. Today, more and more design engineers and material specifiers are calling for FRP composites for equipment used in the refining and processing of a variety of metal ores.

Material costs obviously favor the use of FRP in the construction of mineral processing equipment. An even more compelling argument for their use, however, can be made when

### Cost Comparison of Construction Materials

Construction Material	Cost	Cost Ratio
Shop Fabricated FRP	\$US 40 - 50/sq. ft.	0.9 - 1.0
Field Fabricated FRP	\$US 60 - 70/sq. ft.	1.2 - 1.4
2205 stainless steel 3/8 inch plate	\$US 150 - 225/sq. ft.	3.0 - 4.5
C-276 clad carbon steel	\$US 230 - 330/sq. ft.	4.6 - 6.6

one examines their resistance to corrosion in aggressive hydrometallurgical environments. These processes often require materials of construction that can resist strong acids and high concentrations of acid chloride salts. FRP based on epoxy vinyl ester resin chemistry has the same chemical resistance to acid and better resistance to acid chloride salts than alloy C-276. Moreover, it is superior to 2205 stainless steel in both environments. In fact, depending on the environment, FRP can have a 20 year service life or longer.

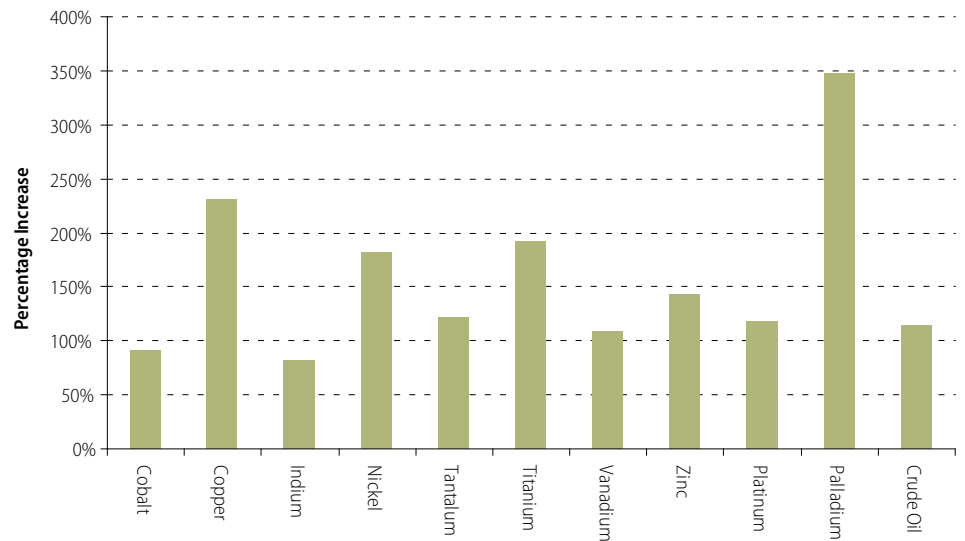
### Mineral Processing Applications

In metal extraction and refining processes, FRP is typically used for pipes, tanks, absorption towers, ductwork, solvent extraction vessels, and electrowinning cells. With the incorporation of the proper filler, FRP piping can provide remarkable durability and corrosion resistance in abrasive slurry piping. Tough Derakane and Hetron resins coupled with these unique fillers deliver exceptional abrasion resistance in the final product. Abrasion resistant FRP piping has proven to last longer and require considerably less maintenance than rubber-lined steel.

Votorantim Metais, one of the ten largest zinc producers in the world recently invested US\$500 million in their Cajamarquilla Refinery to increase production of refined zinc from 160 thousand to 320 thousand tons per year. The project included a sulfuric acid plant and acid plant scrubbers designed by Outotec and constructed by LEPSA S.A. A huge outlay of FRP tanks, scrubbers, piping and ducting was required for this extensive project. Outotec specified FRP made with Derakane™ epoxy vinyl ester resins for all of the FRP equipment due to its wide range of chemical resistance to acids, bases and organic compounds. FRP was found to withstand conditions that would require a considerably more expensive metal alloy.

The US\$4.3 billion Vale Inco Goro Nickel project on the South Pacific island of New Caledonia is another project that has relied heavily upon FRP. More than 6000 MT of FRP went into the construction of this facility. Literally hundreds of storage tanks, scrubbers and processing vessels were specified to be fabricated with FRP based on Derakane™ epoxy vinyl ester resins along with miles and miles of abrasion resistant piping. The established durability of FRP in this demanding corrosive environment along with its inherent economics relative to specialty metals and rubber lined steel drove the decision to choose FRP for this immense project. Although local opposition and processing difficulties have delayed opening of the facility, it is expected

Percentage Price Increase in the Last Two Years (Jan 09 - Jan 11)



to generate 60,000 metric tons of nickel and 5000 metric tons of cobalt annually when commissioned.

The operating conditions associated with mineral processing require materials of construction that can withstand process acids and acid chlorides at temperatures up to 90°C. This service is not compatible with most common metallic materials of construction. Only expensive metal alloys offer the corrosion resistance required. The

use of fiberglass reinforced plastics based on Derakane and Hetron epoxy vinyl ester resins for the construction of electrowinning cells, storage and processing vessels, acid & abrasion resistant piping, ducting and acid plants offers durable and cost saving solutions for these applications. FRP has a distinct advantage over metal alloys and rubber-lined steel with lower installation costs, reduced maintenance and long service life proven with over 20 years of successful operating experience.



Large (10 M dia. X 15 m tall) hydrochloric acid tanks fabricated by PITSA with Derakane 470 epoxy vinyl ester resin for Goro Nickel project in New Caledonia.

# Composite Cargo Tanker Takes Top Honors at ACMA

Corrosion Companies Inc. (CCI) of Washougal, Washington was recognized at the American Composite Manufacturers Association annual meeting for the Best of Show Award for its Composite Cargo Tanker with DuraShield continuity capability. The filament-wound composite tank trailer was designed and built by CCI in partnership with Beall Corporation utilizing a BALTEK SB.100 balsa core and Derakane™ epoxy vinyl ester resin. It is the first of its kind with a DuraShield carbon fiber continuity system for checking the liner integrity. CCI also repairs and inspects the internal liners of DOT lined chemical cargo tankers throughout the U.S.



*Corrosion Companies' composite cargo tanker.*

## Crimar / Zhongyi Provide FRP Solution for Ambatovy Nickel Project

The world's largest nickel mine – the massive \$4.76 billion Ambatovy nickel mine on the African island nation of Madagascar is nearing completion. When it reaches its full production capacity in 2013, the mine will produce 60,000 MT/yr of nickel and 5,600 MT/yr of cobalt. The project will consume miles of FRP piping and hundreds of storage tanks and processing vessels.

One of the many equipment requirements in the Ambatovy project were specialized tank covers for several very large (10.9 - 18.0 meter dia.) thickener tanks. The covers needed to withstand sulfuric acid vapors up to 110° C (230° F) and also be fire retardant. Crimar Industrial (Tucson, AZ), provided the sophisticated design for these demanding covers which included Derakane™ 510C epoxy vinyl ester resin. The covers were designed to allow for removal of single panels or groups of panels for easy access to the rakes within the thickener vessels.

Crimar partnered with Zhongyi GFRP Company based in Hebei, China to fabricate the tank covers. Zhongyi regularly builds fiberglass equipment for projects around the world. It is the largest fabricator of corrosion-resistant fiberglass equipment in China, producing over 60,000 tons of tanks, piping and process equipment annually, and it is a long-time user of Derakane resins.

According to Roger Beman, President of Crimar, "The use of Derakane resins was good for all parties involved in the project. They have a proven worldwide track record that has been growing over the past 60 years. The resins are very consistent in formulation so that



fabricators are very comfortable using them, and the end user can be assured that as long as the end product is used in accordance with the design parameters, he will have a long-term solution for his project needs."

## We want to hear from you!

Do you have a technical question about using an Ashland resin? Want to know what resin is suitable for a given application? Send your inquiries to [derakane@ashland.com](mailto:derakane@ashland.com). We're also looking for interesting news stories and welcome your ideas. Simply send in your question or idea — we'll be in touch soon!



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