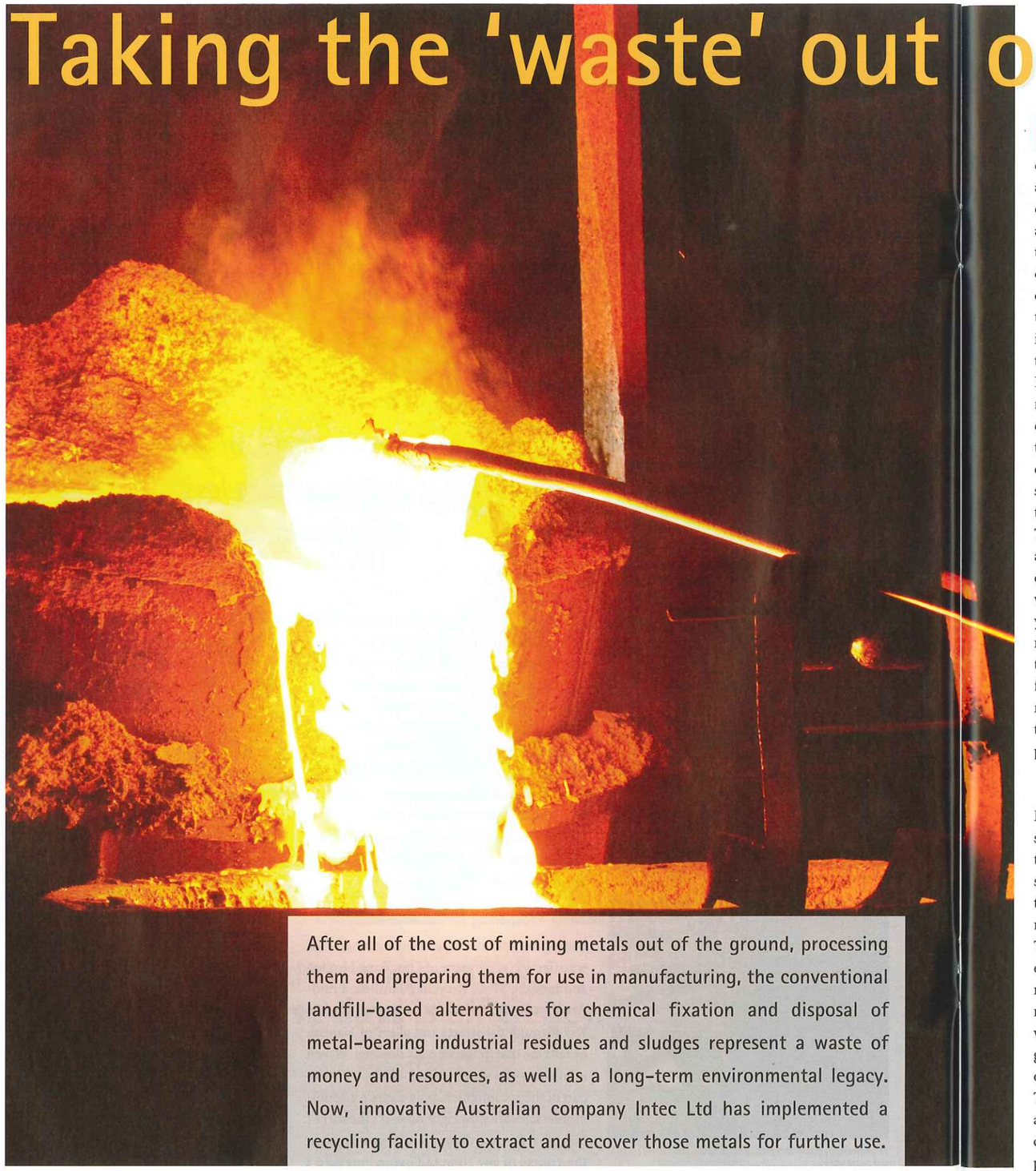
By Dave Sammut

Taking the 'waste' out of industrial wastes



After all of the cost of mining metals out of the ground, processing them and preparing them for use in manufacturing, the conventional landfill-based alternatives for chemical fixation and disposal of metal-bearing industrial residues and sludges represent a waste of money and resources, as well as a long-term environmental legacy. Now, innovative Australian company Intec Ltd has implemented a recycling facility to extract and recover those metals for further use.

Intec Ltd and its wholly-owned subsidiary Intec Envirometals Pty Ltd have applied the patented Intec Process technology to the extraction and recovery of high-grade metal and/or mineral and industrial products from common metalliferous industrial wastes, such as those from the plating industry. With its Australian and developing Chinese operations, the Intec Process offers the opportunity to divert hundreds of thousands of tonnes of industrial wastes from increasingly limited and costly landfill, returning the metals as product to beneficial use.

Having spent the last 15 years bringing its environmental Intec Process technology to commercial readiness for the mining and minerals industry, Intec recognised that the chemical properties of many metalliferous industrial residues are not so different to those of raw minerals being continuously stripped from the ground.

Taking the galvanising and plating industries as examples, these industries commonly produce metal-containing acidic wastewaters from which the metals are precipitated with alkali, yielding sludges and filter cakes. The most common practice for these metalliferous precipitates is chemical fixation with Portland cement, followed by disposal of the full bulked-out tonnage to landfill. As well as being costly, the contained metals are lost forever and become potential problems for the future.

Very aggressive environment

Lead is lead and zinc is zinc, regardless of the source. The Intec Process uses hydrometallurgy to dissolve the metals out of the industrial sludges, to purify these metals, and to recover them as high-grade metal that can act as a direct replacement for freshly-mined metal.

The technology uses a concentrated brine liquid electrolyte. This is a very aggressive environment, requiring low-cost but specialised (mostly non-metal) materials of construction. There is a joke within Intec that marine-grade 316 stainless steel gets its name from the fact that it lasts 316 seconds in the company's electrolyte.

The Intec Process operates at less than 100°C and at atmospheric pressure. By controlling the conditions, the Intec Process can deliver various product options to suit the particular application, with the selected metals ultimately removed either as chemical products via precipitation or as high-grade metal via electrowinning.

Intec has current projects for a range of metal-bearing industrial wastes, primarily targeting lead, zinc, copper, tin and nickel. Due to industry demand, it is also looking at the possibilities for metals such as chromium.

As many different industries use alkali to precipitate metals from wastewater streams (often before recycling the water back into their operations), the ability of the Intec Process to extract and recover the metals from the resulting sludges or filter cakes offers the technology a similarly wide application.

Cheaper and cleaner

Intec boasts that its technology is both cheaper and cleaner than conventional smelting technologies for metal recovery. By operating at low temperatures, the technology does not suffer all of the issues with airborne contaminants that plague smelters, with any iron-based residues from the Intec technology being reusable in several industrial applications. This offers zero-waste applications for appropriate feedstocks.

Life-cycle assessment by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) showed that the Intec Copper Process offers substantial overall environmental advantages versus conventional smelting, albeit with little difference between the two technologies when comparing greenhouse gas emissions in isolation. Although smelting is energy intensive, it gets much of its energy from burning sulphur in its feedstocks - and that's an acid rain rather than a global warming issue.

The Burnie Research facility is the main laboratory fot Intec.

Importantly, the Intec technology is applicable to a broader range of feedstocks, at a more flexible range of tonnage and composition than conventional smelting, allowing the Intec Process to address 'stranded' feedstocks that are unviable in terms of conventional processing.

Awards finalist

In 2009, Intec successfully turned over a portion of its minerals processing research facility in Tasmania to the recycling of metals. In its first major contract, the facility was used to recycle almost 200 tonnes of intractable heavy metal sludge from a local auto parts plating activity. Being too high in metals content to permit landfill disposal, even with cement fixation, the waste had been accumulating for almost 15 years as it waited for a suitable technology to become available.

As a result of its success in this initiative, Intec's Burnie recycling facility was a finalist for both the 2009 Tasmanian Awards for Environmental Excellence and for the prestigious 2009 Banksia Awards.

Recycling galvanising wastes

Approximately half of the new zinc produced every year is used in the galvanising of steel. Meanwhile, spent pickle acid from the galvanising industry can be a significant source of landfill waste. Containing iron, zinc and low-grade acid, common landfill-based technologies produce 2.3 tonnes of waste for every tonne of spent acid treated.

Through its partner in Victoria, Intec has received A$ 780 000 (US$ 690 000) of government funding from EPA Victoria's strategic HazWaste programme to support the demonstration of Intec's proposed zero-waste spent pickle acid recycling application of the Intec Process.

Intec and its partner expect to finalise the programme and construct a recycling facility in Melbourne, Australia, during 2010/2011 for the recycling of at least 1 million litres of spent acid per annum.

Building on this success, Intec has also commenced the development of a project in Australia's south-eastern industrial heartland for the zero-waste recycling of spent pickle acid from the galvanising industry *(see box on page 31)*.

Developing projects in China

The Australian market offers strong environmental regulations that support best practice and innovation, but its industry is comparatively small and widely dispersed. It is a good proving ground for a new technology because success there significantly increases the overseas opportunities.

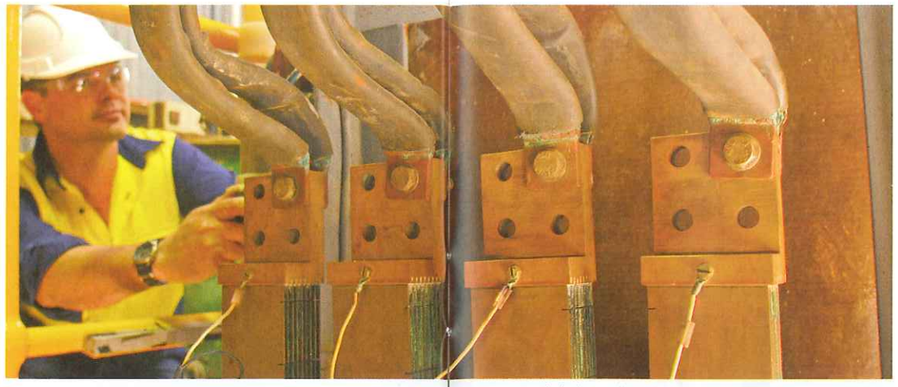
With an increasing focus on environmental outcomes, tightening regulatory controls and continuing strong growth across the industry spectrum, China can be seen as an excellent target for commercial application of the Australian technology. Intec has entered into a joint venture with a Hong Kong-based company called Green Resources (Asia Pacific) Holdings Limited for the implementation of Intec Process projects in China, marrying the Australian technology with the significant pool of local finance and commercially-significant volumes of wastes. The joint venture has so far identified four key potential projects in south-eastern China, with the first to be implemented in 2011/2012.

The Intec process produces zinc of the highest purity.

Starting at 50 000 tonnes per annum and growing to as much as 1 million tonnes of steel industry waste per year, the Liuzhou project looks more like a minerals venture than a metalliferous waste project. The scale dwarfs any comparable Australian effort, and although the supplier of steel dust into the project is 'only' the eighteenth largest in China, Liugang Steel's installed steel production capacity is larger than that of the entire Australian steel industry.

Having passed the pre-feasibility stage, with published returns (IRR) of better than 60%, the Liuzhou project is set to yield rapid international recognition for Intec, while subsequent projects are also likely to be closely watched.

Also located in the Guanxi and Guandong provinces of south-eastern China, three projects are proposed for: the phased recycling of 3 million litres per annum of plating industry wastewater from a single industrial complex of 200 plating companies; recycling up to 1 million tonnes per annum of solid metalliferous residue; and recycling as much as 1 million tonnes per year of mine tailings residue.



The hydro metallurgical strategy enables Intec to extract a wide range of precious metals out of indutrial waste.

Future applications

Of course, there is no single 'magic bullet' technology to divert every tonne of waste from landfill and back into useful service. The Intec Process is applicable to inorganic industrial and mining wastewaters, sludges and residues - it cannot process organics or consumer wastes. And yet when combined with the right organic destruction technology, and possibly even sited at a landfill gate, the Intec Process might in future play an important role in a combined solution to the growing landfill problem.

In the meantime, there are plenty of opportunities offered by inorganic materials.

As noted by Intec's Managing Director and CEO Philip Wood: 'The intricacies and opportunities in the waste industries are endless. We have already shown on the Australian commercial scale that our technology can "crack the nut" of previously intractable heavy metal waste problems, but for every existing project we can see several additional possibilities - far more than we have the resources to develop alone. We are open to discussion with the right potential partner about applying existing steel and plating industry applications internationally, about recovering lead, gold and other metals from e-waste and catalysts, nickel from rechargeable batteries, or chromium from plating wastes or CCA timbers, just to name a few. Who knows where the next few years might lead us?' □

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Green Resources

An ASX-listed Australian public company, Intec announced its joint venture with Green Resources (Asia Pacific) Holdings Limited in November last year. The agreement involves a series of staged cross-investments ultimately providing Intec with 30% of the diluted capital and a board seat at Green Resources on commencement of Liuzhou project operations.

Through Intec, Green Resources has already indicated that it has signed agreements for the on-going supply of steel industry metalliferous waste as feedstock to the Liuzhou project, as well as conditional approval - subject to the current feasibility study - for the approximately 43 million Chinese RMB (A$ 7 million/US$ 6.1 million) of capital required to construct and commission the 50 000-tonnes-per-annum Intec Process plant.

Interview

Recycling International speaks with Philip Wood, CEO and Managing Director of Intec ltd.

What's your technological advantage compared to other EAFD processing technologies, like those of Horsehead (US) and ZincOx (UK)?

They are all more or less based on the Waëlz kiln or similar rotary kilns, high temperature processes for volatilizing crude zinc oxide from EAF dust. There are environmental disadvantages to these methods of processing dust, as the technology is based on the historic forms of pyrometallurgy and among other problems involve large volumes of potentially noxious vapours. We are a hydrometallurgical company. Our technology has no airborne emissions or liquid effluents. In many cases, it has zero waste outcomes. Using our patented technology we can guarantee nearly a 100% recycling rate for the right feedstocks. Not only zinc and lead, but we can also produce substantial volumes of byproducts, such as silver, iron products and others.

You are rolling out your technology now. Why China?

If you consider Europe and the US, it seems that those steelmakers have 'organised' their EAF dust disposal more than in China to date. But China is the most important steel making nation and generally seeks the best environmental technologies for clean production. Understanding that you 'don't make money out of China, but make money with China', we have formed a local joint venture and now we are implementing our technology at the Liuzhou Project. The project can recycle the dust from EAF and BOF, which contains 25% iron, 30% carbon, 7% zinc, 1.5% lead and 250 ppm indium.

At what point is the Intec process starting to be profitable?

This depends on so many issues: What type of waste is it? What is the content? What are the metals prices? What are the disposal fees in the country? If you consider Australia, landfilling now costs over US$200 per tonne in certain states, in Europe about US$150 and the United States around US$100. However in China the situation is the other way around. They give money to the steelmakers to recycle the EAF dust. For EAF dust, at about 30.000 tonnes of waste per annum our technology is profitable in the western world – and at even lower volumes in China. That's a lot lower volume than the competing processes, which need to have much more supply of waste to achieve economies of scale.

How can your technology be useful for the recycling industry?

Especially for recyclers, our technology delivers substantial benefits. Consider e-waste, for example, which contains a wide range of metals and other materials. Our technology can recover from both the circuit boards, and from the leaded glass of CRT televisions and monitors. Recyclers also have the opportunity to expand their business, using the Intec Process to recycle wastes that otherwise would have gone to landfill.

Philip Wood, Intec's Managing Director and CEO.