



CLIENT EXPERIENCE

Helping Jhagadia Copper Limited reduce cost of production by 8 – 10 %

Customer
**Jhagadia Copper
Limited**

Industry
**Metal, Nonferrous,
Copper**

Offering
**Largest producer
of LME Grade "A"
Copper Cathodes
in India**

The global nonferrous metals industry witnessed high growth in 2007 propelled by rising consumption of these metals and robust economy, especially in China and India. Global refined copper metal production in 2007 increased by 4.3% to 18.07 million tonnes and is expected to increase further by 4.9% to 18.95 million tonnes in 2008.

The copper market is primarily price driven and remaining competitive entails controlling the cost of production. Costs depend greatly on the amount of energy consumed and refractory life.

Jhagadia Copper Limited (JCL) is the largest producer of LME Grade "A" Copper Cathodes in India using secondary smelting route. Experiencing productivity and efficiency loss due to excessive heating of refractory lining, the company approached TCS Innovation Labs – Tata Research Development and Design Centre (TRDDC) to address the problem. Drawing from its prior experience in delivering model-based solutions towards energy efficient steel refining and gas fired boiler operation: TRDDC delivered a unique solution for JCL's complex copper smelting process. TRDDC proposed a model based optimization of JCL's Kaldo furnace resulting in a new furnace operating regime.

The solution has improved productivity by 10% and the refractory life by 50-60%. This has led to direct cost savings to the tune of 8-10%, enhancing the cost competitiveness of the company.



TATA CONSULTANCY SERVICES

Experience certainty. IT Services
Business Solutions
Outsourcing

Jhagadia Copper Limited (JCL) is the largest producer of LME Grade “A” Copper Cathodes in India using secondary smelting route. The company was set up in technical collaboration with Outokumpu Technology AB (formerly Boliden Contech AB), Sweden. The capacity of its plant is 50,000 MT per annum of copper cathodes (conforming to LME Grade “A” specification) and 20,000 MTA per annum of copper anodes. In terms of production, JCL has the largest secondary copper smelting plant and is the third largest copper producer in India.

Business Situation

JCL uses Top Blown Rotary Converter (Kaldo) as its main furnace and is one of the very few operations in the world where copper is successfully made through the Kaldo process. The Kaldo furnace at JCL is a top blown, oil-fired rotating converter and is used for smelting and refining of a wide variety of copper-bearing raw materials. The furnace is capable of handling scrap of all kinds with copper content as low as 30% and produces matte grade materials with approximately 70% copper.

The furnace allows flexibility in the usage of raw materials. However, the company was facing furnace lining problems as the average refractory lining heating was close to 30-35 heats (one “heat” is equal to one batch operation). As a result, the Kaldo furnace needed to be shutdown every 15 days on an average and typically for 4-5 days at a time. A lining life of 2 weeks was totally unacceptable for the company as it adversely affected production and efficiency.

According to the then COO, Mr. Bala Kamath “these factors were proving to be major bottlenecks in the plant.”

The company decided to investigate and find a solution for the problem. The company engaged TCS as it was familiar with the latter’s capability to deliver solutions for industrial problems.

TCS Solution

TCS leveraged its premier R&D center in software and process engineering - TRDDC, a part of TCS Innovation Labs for this engagement. TRDDC followed a four-pronged approach to –

- Determine whether the plant practices followed resulted in excessive heating of refractory lining
- Study the influence of key process parameters of thermal profiles on refractory lining
- Obtain parameters for efficient combustion
- Provide recommendations for improved refractory life and energy efficiency

TRDDC leveraged its interdisciplinary team of professionals and the software expertise of TCS for this engagement. TRDDC studied the entire Kaldo operation in detail. TRDDC’s study revealed that although the Kaldo operation is highly versatile, it is energy intensive and involves very high temperature. This has a direct bearing on the refractory life, productivity and energy efficiency of the furnace. As a first step, TRDDC developed a new numerical model taking into consideration the oil combustion and the radiation inside the furnace and the thermal transport in the melt and furnace walls. A CFD based mathematical model of the Kaldo furnace was

developed and employed to optimize the process by Process Modeling and Computational Fluid Dynamics group at Process Innovation Research Lab of TRDDC.

First, a steady-state analysis was carried out for the combustion of oil in the furnace which incorporated the conservation of mass, momentum, species and energy. Transport of oil particles was treated using a Lagrangian framework. The radiation was modeled by the Discrete Ordinates Transfer approach. The CFD model provided the convective and the radiative heat fluxes to the melt and furnace walls and simulated the effect of important process parameters such as oxygen purity, oxygen-fuel ratio, lance position, oil flow rate and melt fill-level on factors which influenced refractory life and productivity. Next, unsteady heat transfer models were developed to analyze the transient melting operation and the temperature evolution in the refractory. These models were mainly used to simulate the entire batch operations of Kaldo process (typically 12 hours) which included cyclic operations of materials loading, oil-firing and de-slagging until nearly 60 tons of matte was ready. Process models were tuned and validated with thermal data from plant. Finally, extensive parametric studies were carried out to identify critical parameters affecting process efficiency, melting rate and refractory temperature.

The analysis helped create a new furnace operating regime that enhanced productivity, efficiency and refractory life in terms of optimum skip schedule, oil flow rate, and percentage of oxygen in air.

Benefits

Though this is TCS' first project in the area of copper smelting, significant value has been delivered to JCL. Plant trials conducted with TRDDC's recommendations during January and June 2008 demonstrated the following benefits –

- Improvement by 70% in the refractory life: 60 heats per campaign were obtained as against 35 heats earlier. This meant that the furnace could run uninterrupted for 60 heats (batch operations)
- 8-10 % cost savings were reported in overall production cost (savings through reduced oil consumption by 30 % and reduced oxygen consumption)
- At least 10 % increase in productivity due to reduced downtime
- Lowering of green house emission

“Team members were well versed with tackling complex industrial problems and given their academic background coupled with the professional experience, the project was dealt in a very systematic manner. The project execution was truly collaborative. During the course of execution, TRDDC team visited JCL twice for data collection, process understanding and detailed discussions. JCL team visited TRDDC twice for in-depth analysis of solutions being developed. Both teams were in constant touch at all stages of the execution of the project. These constant interactions resulted in recommendations which can be implemented on the shop floor.”

- Mr. Kalyan Guha,
Vice President (operations), JCL

About Tata Consultancy Services

Tata Consultancy Services Limited is an IT services, business solutions, and outsourcing organization that delivers real results to global businesses, ensuring a level of certainty no other firm can match. TCS offers a consulting-led, integrated portfolio of IT and IT-enabled services delivered through its unique Global Network Delivery Model™, recognized as the benchmark of excellence in software development.

A part of the Tata Group, India's largest industrial conglomerate, TCS has over 100,000 of the world's best trained IT consultants in 50 countries. The company generated consolidated revenues of US \$5.7 billion for fiscal year ended 31 March 2008 and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

For more information, visit us at www.tcs.com.

Contact

To know more about us Contact
Innovation.info@tcs.com or
pune.processlab@tcs.com

All content / information present here is the exclusive property of Tata Consultancy Services Limited (TCS). The content / information contained here is correct at the time of publishing. No material from here may be copied, modified, reproduced, republished, uploaded, transmitted, posted or distributed in any form without prior written permission from TCS. Unauthorized use of the content / information appearing here may violate copyright, trademark and other applicable laws, and could result in criminal or civil penalties.

Copyright © 2008 Tata Consultancy Services Limited