Tata Steel

Reduction of trivalent chromium in steel-making by-product slag

CHEMICALS

Background

The Linz-Donawitz (LD) process, also known as the basic oxygen steelmaking process, is a method of refining molten pig iron into high-quality steel by blowing pure oxygen into a basic refractory furnace. This process oxidizes impurities like carbon, silicon, phosphorus, and manganese, creating a by-product called LD slag. Tata Steel Limited, Jamshedpur has developed a patented technology for producing a first of its kind soil conditioner from the LD slag fines which contains all the essential nutrients required for soil health and plant growth, including calcium, sulfur, iron, silicon, phosphorus, and magnesium. LD Slag is one of the most significant by-products of integrated steel plants around the world, particularly from the perspective of government agencies, regulatory bodies and local authorities. India generates more solid waste per ton of steel (approximately 1.2 tons) compared to Western countries (around 0.55 tons). Among this waste, LD slag contributes substantially, accounting for 120 to 180 kg per ton of steel produced. Current LD steelmaking processes generate slag with chromium concentrations that exceed acceptable thresholds for reuse, creating a pressing need for scalable solutions that enable this by-product transformation into valuable agricultural inputs.

The typical chemical analysis of LD slag is as shown in the table below.

Compound	Concentration (wt.%)
Al_2O_3	1.175
CaO	50.69
Cr_2O_3	0.153
Fe	17.005
K_2O	0.0
MgO	5.27
MnO	0.74
Na_2O	0.0
P_2O_5	3.42
S	0.023
SiO_2	13.63
TiO_2	1.137

What we're looking for

We are looking for solutions capable of reducing trivalent chromium concentrations from over 1500 ppm to less than 100 ppm in LD slag, ensuring safety and enabling its sustainable reuse.

Solutions of interest include:

- Organic processes
- Inorganic processes
- Electrochemical extraction
- Hydrometallurgical treatment
- Chemical treatment/stabilization
- Selective leaching
- High-temperature sintering
- Crystalline phase transformation

Our must-have requirements are:

- Ready to implement or requiring minimal adjustments
- Heavy metal reduction
- Easy to implement and maintain

Our nice-to-have's are:

- Percentage constituents of existing elements like Ca, S, Fe, Si, P, and others should not be reduced

What's out of scope:

- Steel-making processes involving LD converter
- Solutions that interfere with the operability and productivity of existing processes

Acceptable technology readiness levels (TRL): Levels 8-9

1. Basic principles observed
2. Concept development
3. Experimental proof of concept
4. Validated in lab conditions
5. Validated in relevant environment
6. Demonstrated in relevant environment
7. Regulatory approval
8. Product in production
9. Product in market

What we can offer you

Eligible partnership models:

- Supply/purchase
- Sponsored research

Benefits:

Sponsored Research

Tata Steel would fund the implementation, with the amount of funding to be discussed after the techno-commercial finalization of the proposal, subject to a tentative budget of up to $100,000.

Expertise

Partner will be assigned a representative from Scientific Services at Tata Steel. They will assist the partner during the project as required.

Tools and Technologies

Partners will be allowed to do local customization of instruments. They can also access our lab facilities.

Data

After NDA is signed we can share required data.

Facilities and Services

Partner will be invited to concerned plant or facility for survey and on site understanding of the challenge (video call may also be explored). Required help will be given from Tata Steel to the selected partner.

Reviewers

Shikha Suman

Area Manager Program Management

Please contact the University of South Florida Technology Transfer office representative for submission - Karla Schramm at kschramm@usf.edu