Course Name	Mineral Processing and Extractive Metallurgy

Class	T.Y. 2021
Faculty	Dr. A. M. More

Every student was given a dedicated research paper for study

	A	B	C	D	E
1	Sr. No	MIS	Name	Topic - Intro	Link for Suggested relavent Paper (You may choose another Paper)
13	12	111911011	DHEKANE SHAUNAK	Simulation of Electroslag Remelting	https://www.tandfonline.com/doi/full/10.1080/10407782.2014.937208?casa_token=qTWq3zJIC-oAAAAA%3AgNGT42-NWtTubelxf8FQdbkrsB6tSzKxLk3-FCmMOPFyEaudj5fL5uMPzHbi6zDEEltRo6oacPAKwoXl
14	13	111911012	DHIRAJ VILAS DAKHOLE	PROCESSING OF ANODE SLIMES	http://midra.uni-miskolc.hu/document/22211/16561.pdf
15	14	111911013	HARSH ANIL VAIDYA	reuse copper ore tailings	https://www.degruyter.com/document/doi/10.1515/chem-2021-0194/html
16	15	111911014	HUJEFA RIYAJ SHAIKH	Boron Removal from Silicon Using Secondary Refining Techniques	https://www.tandfonline.com/doi/full/10.1080/15422119.2018.1523191?casa_token=dpo9f3MNJCIAAAAA%3Af8X6n1BWHWUyhrt7sya9tRf_huxpR-p9-F4ikcW6L0od4fzxhBmppfK_-IAP_bZnAEXFJ_SMqkK0Rgia
17	16	111911016	JAYDEEP RAMESH INGALE	a Recycling Plant	https://www.mdpi.com/2313-4321/2/4/19
18	17	111911019	KHARWADKAR PRIYAL	Extraction of Rare Earth from magnet waste	https://www.jstage.jst.go.jp/article/serdj/21/2/21_137/_article/-char/ja/
19	18	111911020	KOMAL SANDEEP PANDYA	Recovery of metal from electronic Waste	https://www.researchgate.net/profile/Muammer-Kaya-2/publication/295605709_Recovery_of_Metals_from_Electronic_Waste_by_Physical_and_Chemical_Recycling_Processes/links/56cbfacc08ae1106370bb0cb/Recovery-of-Metals-from-Electronic-Waste-by-Physical-and-Chemical-Recycling-Processes.pdf
20	19	111911021	KRUSHNA ADINATH DETHE	Decomposition of Nickel Concentrates	https://link.springer.com/content/pdf/10.1007/s11663-010-9466-1.pdf
21	20	111911023	KUSHAL SHRIKRUSHNA DEULKAR	The effect of tri-sodium citrate on the cementation of gold from ferric/thiourea solutions	https://www.sciencedirect.com/science/article/pii/S0304386X11001939?casa_token=UdRBq_mTtksAAAAA:IFylmk90GngZ6FAQkfKoZPU54KHjtYa2mUaXEgMsu7bcg81YMdaJqA61tm8MCexEpYOoyVZ-ThQ
22	21	111911024	MADHURA ARVIND MAHAMUNI	Physical Modelling of Metal Refining Process	https://www.mdpi.com/2075-4701/8/9/726

List of topics 2021 | List of Topics 2022 | test 2022 | Sheet2 | List of Topics 2022 (2)

Ready | Accessibility: Unavailable

76 Students were given 76 separate Research Papers for study,

few students used additional papers apart from assigned once

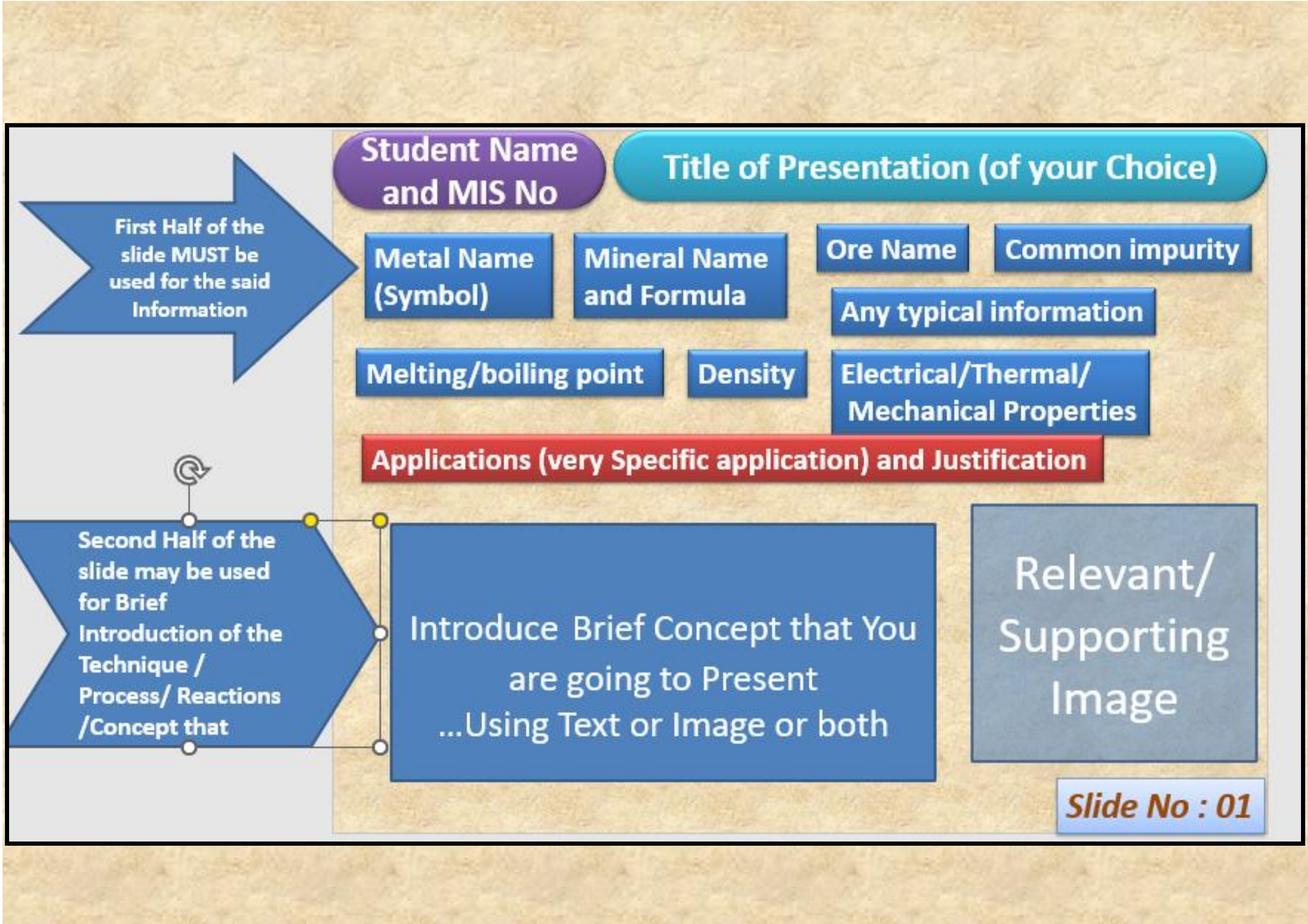
	A	B	C	D	E
1	Sr. No	MIS	Name	Topic - Intro	Link for Suggested relavent Paper (You may choose another Paper)
58				smelting plant, process and equipment	Wm7y1oxy3ZMTFdtup-I3KCX2p7IyBeO9sDtoWljAi8Rn3Rh4z
59	58	111911064	PARAS GORAKSHNATH UBALE	Recycling Rare Earth Metals Fluroscent bulbs	https://link.springer.com/chapter/10.1007%2F978-3-319-48188-3_29
60	59	111911065	SHRADDHA MANOJ GUJAR	Effect of South Africa Chrome Ores on Ferrochrome Production	https://ujcontent.uj.ac.za/vital/access/services/Download/uj:4729/CONTENT1
61	60	111911066	BHOSALE INDRANEEL SANJAY	Extraction of indium from zinc plant residues	https://www.sciencedirect.com/science/article/pii/S0892687509002325?casa_token=mAPbFp3xdyYAAAAA:Oq09cqNwYZ9sVZhMdSl2fiSi4ZrHJN7aBFm7ODPZ__84sT3w9ktTnAO02S1Co344bguz3QevtFo
62	61	111911067	BHOSKAR YASH DEEPAK	removal of boron from silicon	https://link.springer.com/article/10.1007/s11837-012-0382-5
63	62	111911068	BRAHMANKAR PRATHMESH MANOJ	Recovery of gold and silver from spent mobile phones	https://www.sciencedirect.com/science/article/pii/S0304386X12002691?casa_token=i3nixMMd3t4AAAAA:8LzE-9MTT_i398u3LlbtgQDTHWQpMIZjoWl7NQZAzaembD0JY2gbS6KudavWMiCx7dmExrgRdRg
64	63	111911069	CHANDORE MOHIT DEVENDRA	Copper recovery from waste printed circuit boards (electronic circuits)	https://link.springer.com/article/10.1007/s11783-017-0997-4
65	64	111911070	CHORMALE SRUSHTI BHAUSAHEB	Pyrometallurgical Extraction of Valuable Elements in Ni-Metal Hydride Battery Electrode Materials	https://link.springer.com/article/10.1007/s11663-015-0362-6
66	65	111911071	GHUGE PRASAD PRAKASH	manganese extraction from low-grade ores	https://www.sciencedirect.com/science/article/pii/S2095268614000950
	66	111911072	HENDRE ATHARVA PRASHANT	Pyrometallurgical Extraction of Tin Metal from the Egyptian Cassiterite	https://www.researchgate.net/profile/Wael-Fathy-6/publication/339442938_Pyrometallurgical_Extraction_of_Tin_Metal_from_the_Egyptian_Cassiterite_Concentrate/links/5e52ad6c92851c7f7f55082a/Pyrometallurgical-Extraction-of-Tin-Metal-from-the-Egyptian-Cassiterite-

List of topics 2021 | List of Topics 2022 | test 2022 | Sheet2 | List of Topics 2022 (2)

Ready | Accessibility: Unavailable

Guidelines and Rules for Presentation

- Final date of submission : 16/10/2021 – 11.00 PM |||| Total number of Slide : **04**.
- **Slides Contents:** First **2**(main) **+ 3**rd (Reference) + **4th** (Additional slide **if needed**)
- Slide No. **1** and **2** is to be explained. Slide No. **3** : References & exact source of information must be mentioned. In **4th** Slide you may store data needed to explain the anticipated questions asked by your friends / examiner.
- Use Images/Schematics/Flow Charts from research papers for explanation of
- Use of flow chart from HS Ray Book/Other Books **is Strictly Not allowed**.
- **At least ONE good research papers, published after Year 2010, must be thoroughly studied and presented.**
- Use Images, Text Box-Font Size, Colour combinations as per your choice.
- When you Submit, **File Name** should start with **Your MIS Number**
- **Refer** https://libguides.du.edu/engineering/citations
- https://www.huffpost.com/entry/**how-to-read-and-understand-a-scientific-**paper_b_5501628


First Half of the slide MUST be used for the said Information
Student Name and MIS No
Title of Presentation (of your Choice)
Metal Name (Symbol)
Mineral Name and Formula
Ore Name
Common impurity
Any typical information
Melting/boiling point
Density
Electrical/Thermal/ Mechanical Properties
Applications (very Specific application) and Justification
Second Half of the slide may be used for Brief Introduction of the Technique / Process/ Reactions /Concept that
Introduce Brief Concept that You are going to Present ...Using Text or Image or both
Relevant/ Supporting Image
Slide No : 01

This Slide is Most Important Slide,
Give your 100% to design this slide.

Full freedom is with you to use this Slide the way you want

Use of Images / Schematics from research papers are expected to explain/showcase/ demonstrate Mechanism/ Principle / Newer Research finding/ innovative techniques / methodology / Function / Characteristics / Concept……

Mention Process Parameters / Reactions / Relevant information.

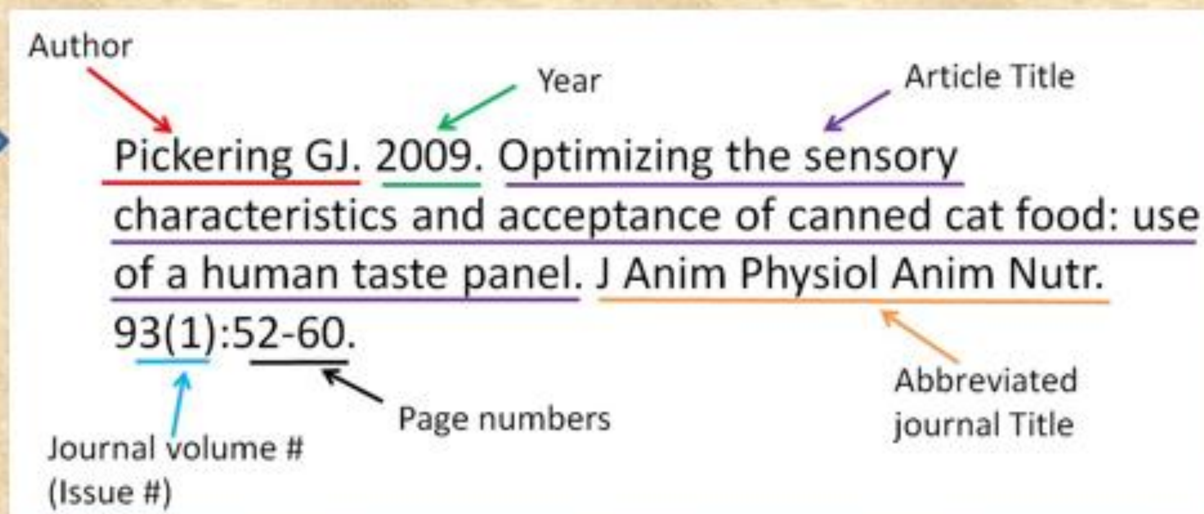
Refer Following Link

https://www.huffpost.com/entry/**how-to-read-and-understand-a-scientific**-paper_b_5501628

References

1. Cite referred research paper at First here.

Example ....



2. Mention other important ...sources here onwards
3. .....
4. .....
5. .....

For More Information REFER

https://libguides.du.edu/engineering/citations

Presentations by student

Student : Ms. Pavitra Sangrulkar

Extraction of Chromium

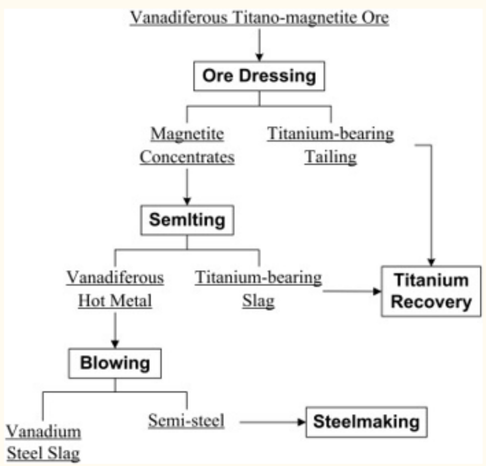
Name - Pavitra Sangrulkar
MIS - 112011073

- **Cr :** atomic number 24
- Chromite ore ($FeCr_2O_4$)
- Melting point of 1907 °C (3465 °F)
- Boiling point of 2671 °C (4840 °F)
- Density : 7.15 g/cc
- Crystal Structure : BCC
- Antiferromagnetic
- Electricity Conductor

- **Other Properties**
- steely-grey, lustrous, hard, and brittle transition metal
- strong oxidising agent
- extremely hard

- **Applications:**
- Alloying element : High-speed tool steels contain between 3 and 5% chromium
- Stainless steel : corrosion-resistant (11% Cr)
- surface coating

- Extracting chromium from a finely divided chromium ore
- (roasting and leaching of chromite to separate it from iron, followed by reduction with carbon and then aluminium)
- First crushed -size of less than about 250 microns
- Salts of sodium are to prepare molten bath:- 800° to 900°C
- Gas used for the oxidation - oxygen/air
- Gas introduced in bath of molten salts by bubbling or agitating
- Chromium ore in the divided state is held in suspension in the molten bath
- Lime used to precipitate the silica and/or alumina
- Oxidation catalyst such as iron oxide or manganese oxide
- Chromate formed by oxidizing action- recovered by immersion of the reaction product in H_2O
- Crystallized by simply cooling



Presentations by student

Student :

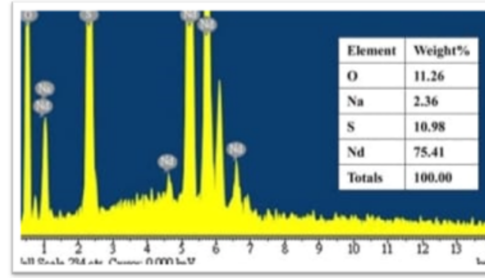
Mr. Abhay Khade

Name:-Abhay Chandrakant Khade
MIS:-111911001

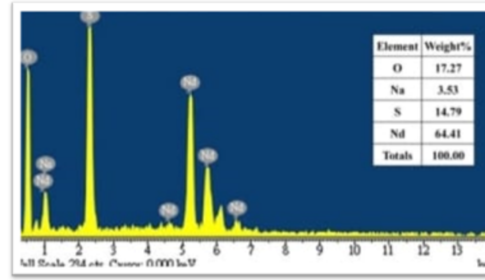
Title :- Selective Leaching Process for Neodymium Recovery

Metal Name and Symbol	Neodymium (Nd)
Mineral Name and Formula	Monazite(Ce,La,Nd,Th)(PO4,SiO4), bastnasite(Ce,La)Co3F
Common Impurity	Cobalt , Nickel , Copper
Melting Point / Boiling Point	1297 K / 3347 K
Density	7.01 g/cm^3
Electrical & Thermal Properties	0.667 10^6 s / m & 7.7 kcal / (m.h.°C)

Neodymium belongs to the lanthanide series and is a rare-earth element.



Application:- Neodymium has an unusually large specific heat capacity at liquid-helium temperatures, so is useful in Cryocooler.



In this study, we developed a simple hydrometallurgical precipitation process with pH adjustment to separate and recover Nd 100 pct recovery from scrap Nd-Fe-B magnets.
the purity and weight percentage of the obtained Nd product was analyzed using scanning electron microscopy–energy-dispersive spectroscopy (SEM-EDS) analysis..

Nd-Fe-B magnetic samples were treated by a series of physical separation processes such as demagnetization, grinding, and screening to enrich the metal content for further recycling steps

Table I. Effect of Time and Temperature on Demagnetization

Temperature [K (°C)]	Time (Min) 15	30	60
523 (250)	not removal	not removal	not removal
573 (300)	not removal	partial removal	total removal
623 (350)	total removal	total removal	total removal
723 (450)	total removal	total removal	total removal

Leaching recovery(%)=(w1/w2)*100 %

Precipitation efficiency(%)=[(Wb-Wa)/Wb] *100 %

$$Nd(s) + H^+X^-(aq) \rightarrow Nd^{3+}(aq) + H_2(g) + X^-(aq) \quad [2]$$

$$Fe(s) + H^+X^-(aq) \rightarrow Fe^{2+}(aq) + H_2(g) + X^-(aq) \quad [3]$$

$$B(s) + H^+X^-(aq) \rightarrow B^{3+}(aq) + H_2(g) + X^-(aq) \quad [4]$$

Table II. Leaching Operating Conditions of Scrap Nd-Fe-B Magnet

Leaching Reagent	Concentration (N)	Temperature [K (°C)]	Time (Min)	Solid/Liquid Ratio (g/mL)
Hydrochloric acid	0.1, 0.5, 1, 3, 6	300 (27), 343 (70)	1, 5, 10, 15, 30, 45, 60, 90, 120	0.02, 0.04, 0.1
Sulfuric acid	0.1, 0.5, 1, 3, 6	300 (27), 343 (70)	1, 5, 10, 15, 30, 45, 60, 90, 120	0.02, 0.04, 0.1
Nitric acid	6	300 (27), 343 (70)	120	0.02
Sodium hydroxide	6	300 (27), 343 (70)	120	0.02

Results and Discussion

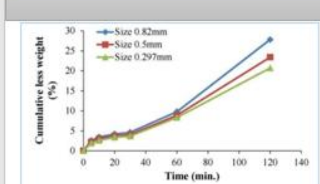


Fig. 1—Effect of time on cumulative less weight percentages of various sized demagnetized particles (100 g sample with 15 balls).

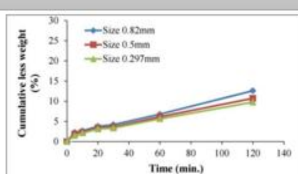


Fig. 2—Effect of time on cumulative less weight percentages of various sized demagnetized particles (100 g sample with 8 balls).

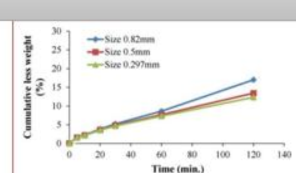


Fig. 3—Effect of time on cumulative less weight percentages of various sized demagnetized particles (200 g sample with 15 balls).

Presentations by student

Student :
Mr. Yashwardhan Pathare

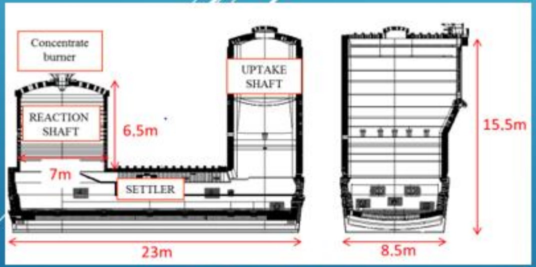
YASHWARDHAN PATHARE
MIS: 111911061

Copper Smelting Process Balance Modelling

- Metal :- Copper
- Symbol :- Cu
- Ore Name :- Chalcopyrite
- Mineral Formula :- $CuFeS_2$
- Natural Impurities :- Galena and sphalerite
- Application :- Due to its very high electrical conductivity resulting in low power losses, copper is extensively used in electrical wires and power transmission lines.
- Density :- 8.94 g/cm^3
- Melting Point :- 1083°C
- Boiling Point :- 2595°C
- Electrical Resistivity :- 1.82-4.9 x 10^{-8} ohm.m
- Mohs Hardness :- 3.0
- Young's Modulus :- ~127 GPa
- Poisson's Ratio :- 0.34-0.35
- Shear Modulus :- 44-49 GPa
- Thermal Conductivity :- 147-370 W/m.K
- Thermal Expansion :- 16.8-17.9 x 10^{-6}/K

In copper flash smelting process, process control is achieved by calculating mass and energy balance, which in turn determine the operational parameters of the system.

This article aims at modelling the copper flash smelting process by modifying the classical balance methodology with the use of distribution coefficients and molecular ratios calculated with the FactSage™ software of the flash furnace operation. It also includes a comparison of the data so obtained with industrial operational data.



Flash Smelting Furnace

KEY POINTS

- Key variables to be controlled :-
- Matte grade, by setting O_2 coefficient.
- SiO_2 in slag, by appropriate flux dosing.
- Slag temperature, by O_2 enrichment or by additional hydrocarbon burners.

$$\text{enthalpy of the components entering the furnace} + \text{furnace heat losses} = \text{enthalpy of the components leaving the furnace}$$

- Other Important Points :-
- Concentrate blends are characterized by their S/Cu ratio.
- Gibbs free energy minimization technique through FactSage™, for equilibrium masses and compositions.
- Copper chemical loss of ~1% in slag.

$$D_{Cu}^{matte/slag} = \frac{C_{Cu}^{matte}}{C_{Cu}^{slag}}$$

$$0 = -SO_2^{offgas} + \left(\frac{SO_2}{SO_3}\right)^{offgas} \times SO_3^{offgas}$$

$$0 = D_{Cu}^{matte/slag} \times Cu_2S^{matte} \times \frac{Cu\ wt\%\ in\ Cu_2S^{matte}}{100} - Cu_2S^{slag} \times \frac{Cu\ wt\%\ in\ Cu_2S}{100} - Cu_2O^{slag} \times \frac{Cu\ wt\%\ in\ Cu_2O}{100}$$

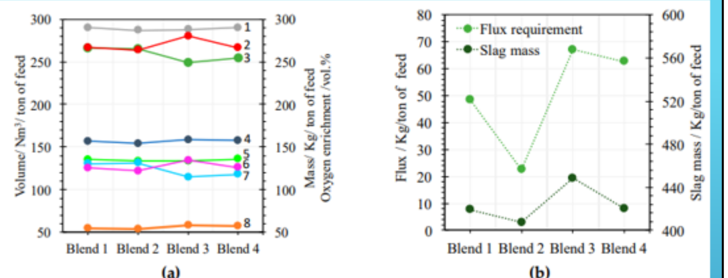
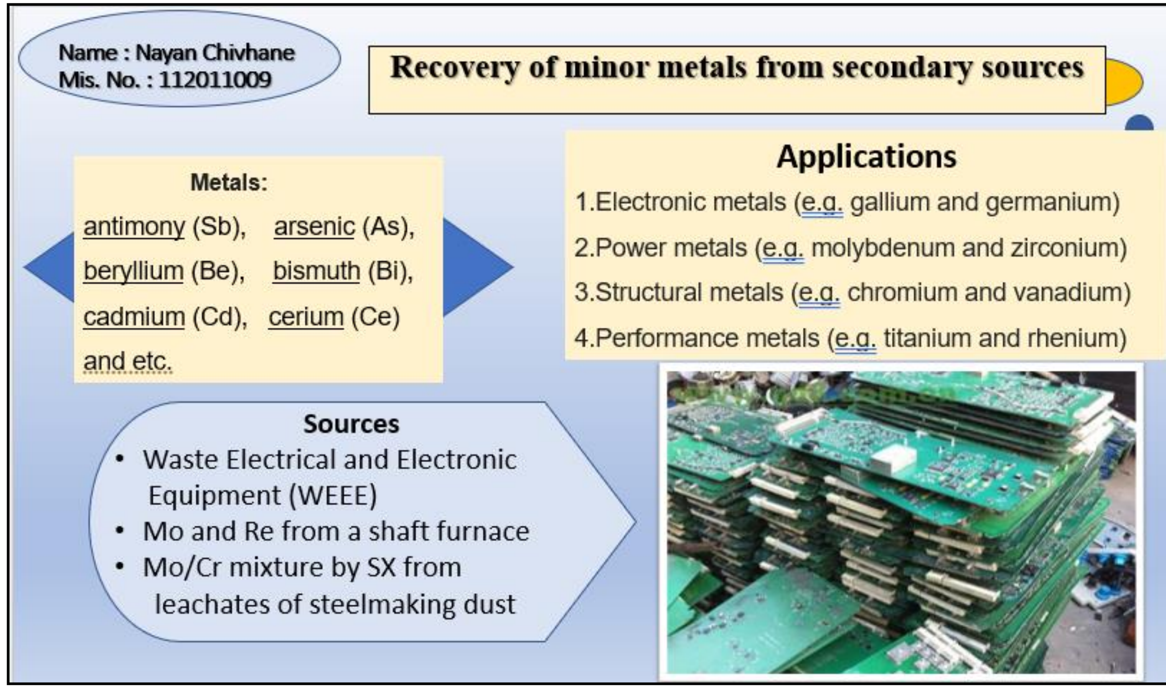


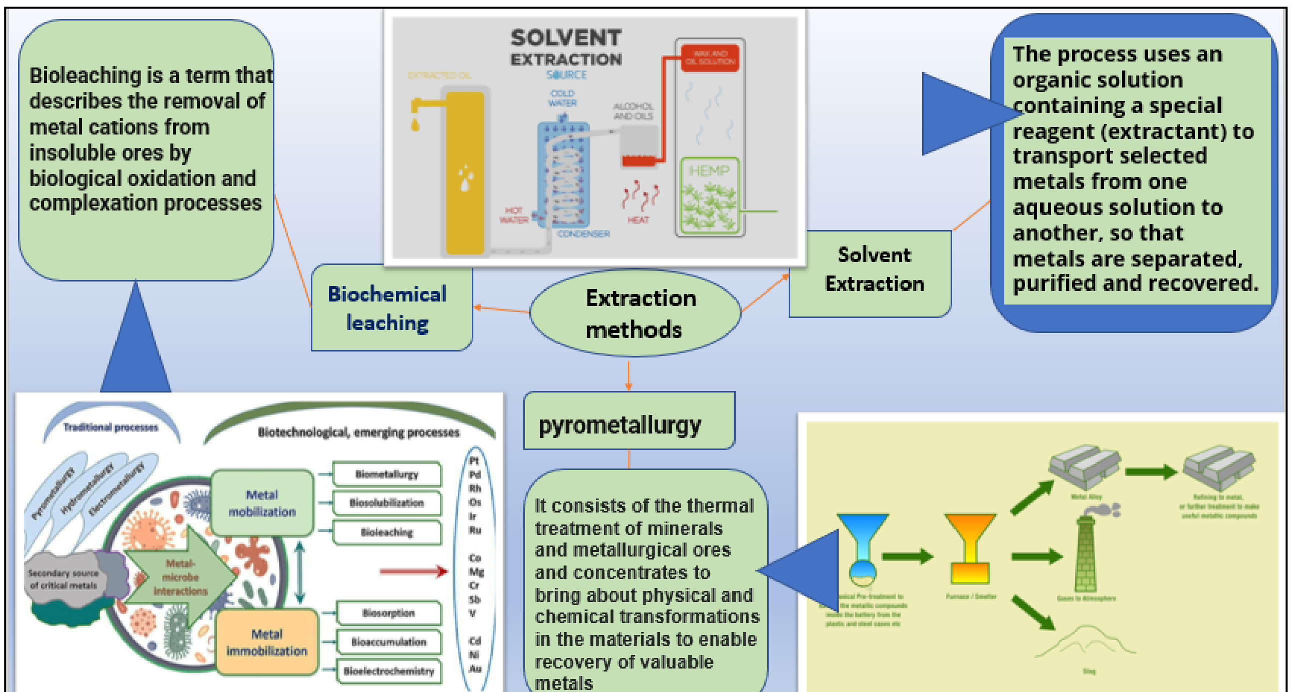
Figure 3. (a) 1: Sulfur mass (kg/ton of feed). 2: Iron mass in blend (kg/ton of feed). 3: Off gas mass (kg/ton of feed). 4: Oxygen coefficient (Nm^3/ton of feed). 5: Sulfur dioxide mass (kg/ton of feed). 6: Silica mass in the slag (kg/ton of feed). 7: Nitrogen in off gas (Nm^3/ton of feed). 8: Oxygen enrichment (vol.%). (b) Flux requirements (kg/ton of feed) for blends 1 to 4. (green). Slag mass (kg/ton of feed) (black).

- About the Outotec flash smelting process (Atlantic Copper Smelter) :-
- Such furnaces consist of reaction shaft, settler, uptake shaft.
- Well-dispersed oxygen, air, dried concentrate and flux.
- Modelling was carried for 4 blends with 12 types of single concentrates.
- Calculations done for process temperature of 1300°C

Presentations by student

Student :
Mr. Nayan Chivhane





Outcomes of this Exercise

Research Paper Related Assignment

Students Introduced to

- Research Journal Literature Review for interdisciplinary/ collaborative-multidisciplinary scientific research
- Recent Development in Processing and Technology in the filed of Metal Extraction
- Self Learning
- Technical Data Presentation and Communication Skill

Program Outcomes (Graduate Attributes) addressed

PO 1 : . Problem Analysis

PO 4 : Conduct investigations of complex problems

PO7 : Environment and sustainability

PO 10 : Communication

PO12 : Life-long learning