Chromium ore enrichment (beneficiation) technology

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Plan:

I Introduction

Chromium

II Main section

Chromium ore and its classification

Minerals of chromium

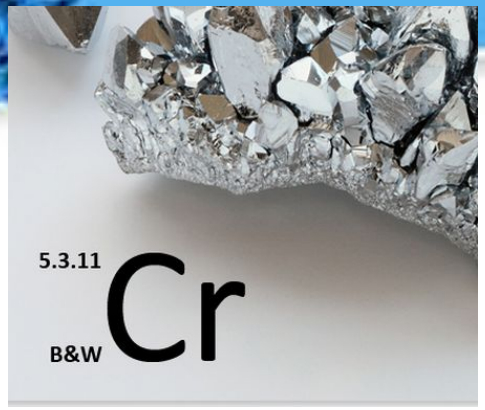
Chromium ore beneficiation technology

Chromium ore production

Technological schemes

III Conclusion

IV References



Introduction

Chromium is a chemical element with symbol Cr and atomic number 24. It is the first element in group 6. It is a steely-grey, lustrous, hard and brittle metal which takes a high polish, resists tarnishing, and has a high melting point. The name of the element is derived from the Greek word χρομα, chrōma, meaning color, because many chromium compounds are intensely colored.

n 1794, Louis Nicolas Vauquelin received samples of crocoite ore. He produced chromium trioxide (CrO3) by mixing crocoite with hydrochloric acid. In 1797, Vauquelin discovered that he could isolate metallic chromium by heating the oxide in a charcoal oven, for which he is credited as the discoverer of the element. Vauquelin was also able to detect traces of chromium in precious gemstones, such as ruby or emerald.

$PbCrO_4$

Chrome and its ores

- Chromium is a fairly common element in the earth's crust (0.012% by mass) . The main compounds of chromium are chromite iron ore (chromite) $FeO \cdot Cr_2O_3$. The second most significant mineral is the crokoite $PbCrO_4$.
  99% of the deposits of chromium are found in the Mugod mountains. The Kem-Pirsai and Don groups of deposits containing high-grade ores are very popular. Chromite deposits are also discovered in Kostanai and East Kazakhstan regions,
  Kazakhstan came out on the second place in the world for reserves and annual production of chromite ores. These ores are a mandatory component in the smelting of stainless steel. Chromium is exported to 40 countries of the world. 97% of chromites in the CIS are mined in Kazakhstan.


Петропавл
Қостанай
Көкшетау
Степняк
Таволжан
Павлодар
Ертіс
Рудный
Зырян
Өскемен
Зайсан көлі
Кендірлік
Обаган алабы
Лисаков
Тобыл
Сарыбұлақ
Есіл
Әйет
Жетіқара
Орал
Қарашығанақ
Ақтөбе
Хромтау
Кемпірсай
Қандыағаш
Жайық
Жем
Астана
Арқалық
Торғай
Теңіз көлі
Қарағанды
Қарағанды басс.
Бат. Қаражал
Атасу
Жезді
Жезқазған
Жақсылық
Құмкол
Сарысу
Шығыс Қоңырат
Қоңырат
Сарық
Балқаш көлі
Алакол
Қашқантеңіз
Талдықорған
Текелі
Іле
Шу
Алматы
Ащысай
Қаратау
Тараз
Шымкент
Лениер
Қызылорда
Сырдария
Арал теңізі
Каспий теңізі
Ақжайық
Қосшағыл
Прорва
Теңіз
Қаламқас
Жетібай
Өзен
Тас көмір
Қоңыр көмір
Мұнай
Табиғи газ
Темір
Марганец
Хромит
Вольфрам
Молибден
Никель
Алюминий
Мыс
Полиметалл
Алтын
Асбест
Фосфорит
Ас тұзы
Мирабилит
Цемент
Шыны құмы
225 км

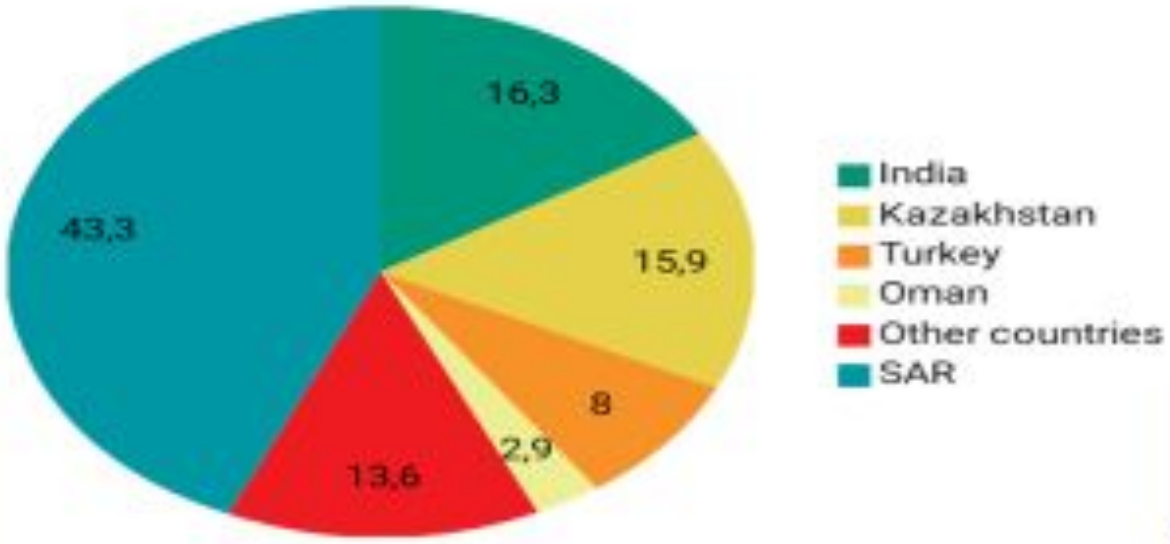

24kz

ДОНСКОЙ ГОРНО-ОБОГАТИТЕЛЬНЫЙ КОМБИНАТ- It was built in 1938 on the basis of the known group of the South Kempirsay deposits since 1936. The main industrial center is Khromtau. Includes 4 quarries, a crushing and dressing plant, etc.
The main ore mineral is chromospinelide, the secondary ore is magnetite, magnesite, etc.
Development system - transport with external dumps.
Depth of mining up to 150 m.
Excavation in the face is selective.
Mining Transport equipment: excavators, dump trucks.
Enrichment of ore with Cr2O3 content less than 43% gravitational (in heavy media). All commodity ore is sorted by fractions. At the enrichment plant, there is a recycling water supply.

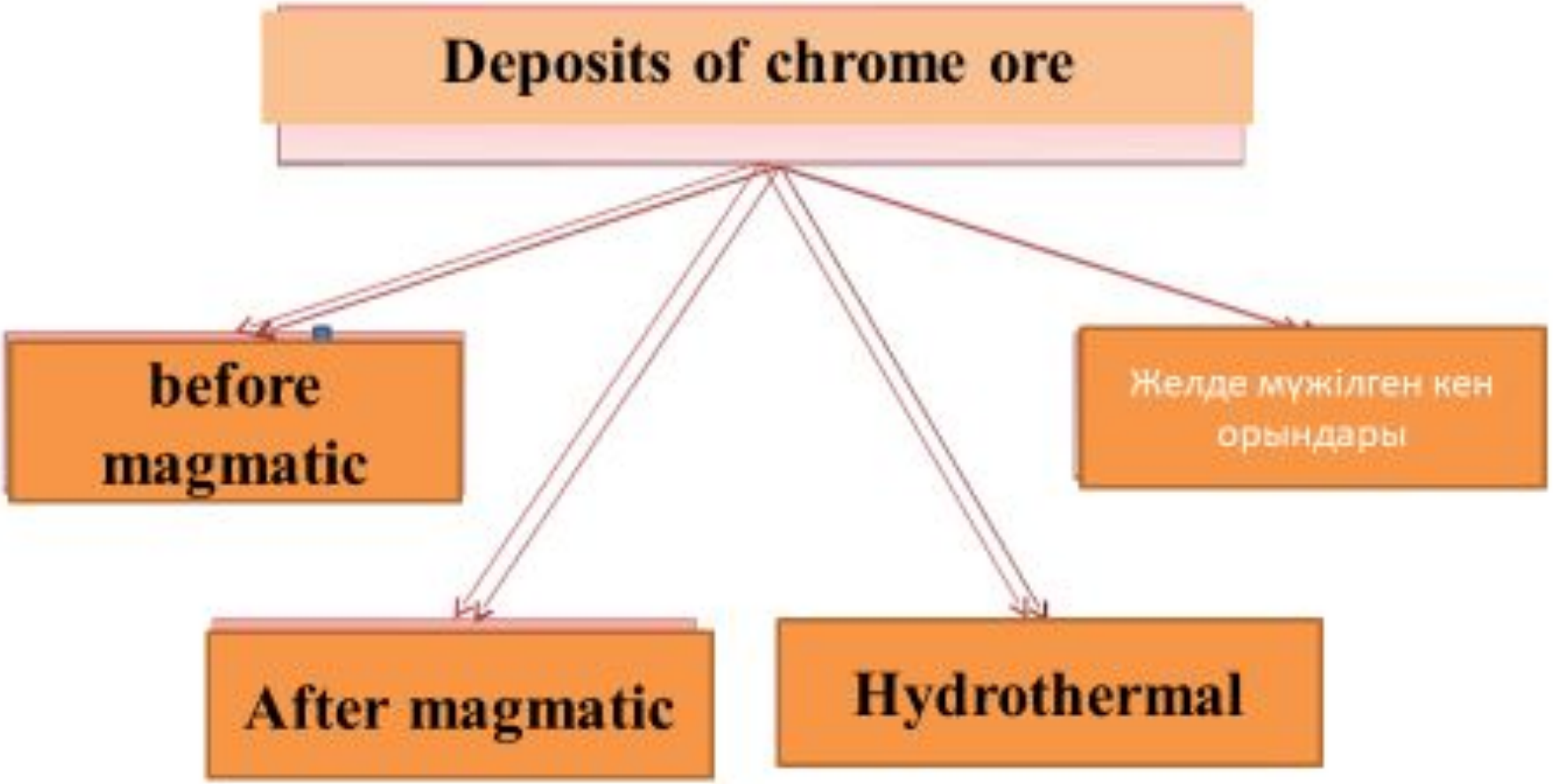
From the data US Geological Survey Information (Million tons)

Countries	Accumulated stock:	Resource
Albania	6100	6100
Brazil	14.000	17.000
Finland	41.000	120.000
India	27.000	67 000
Iran	2400	2400
Kazakhstan	320 000	320 000
Russia	4000	460 000
SAR	3.000.000	5.500 000
Turkey	8000	20 000
Global resources	3.600 000	7.600 000

Extraction of chromites by countries of the world



In general, the reserves of four Donskoi GOK field exceed 334 million tons. Donskoi GOK commissioned the world's largest mine for the extraction of chrome ore. In the world, 11_13 million chromites are mined annually and they use them for chrome plating of steel.


Deposits of chrome ore
before magmatic
Желде мүжілген кен орындары
After magmatic
Hydrothermal

Minerals of chrome

magnochromite (Mg, Fe)Cr2O4

Alumochromite (Fe, Mg) (Al)2O

Chrompicotite (Mg, Fe) (Cr, AI)2O4

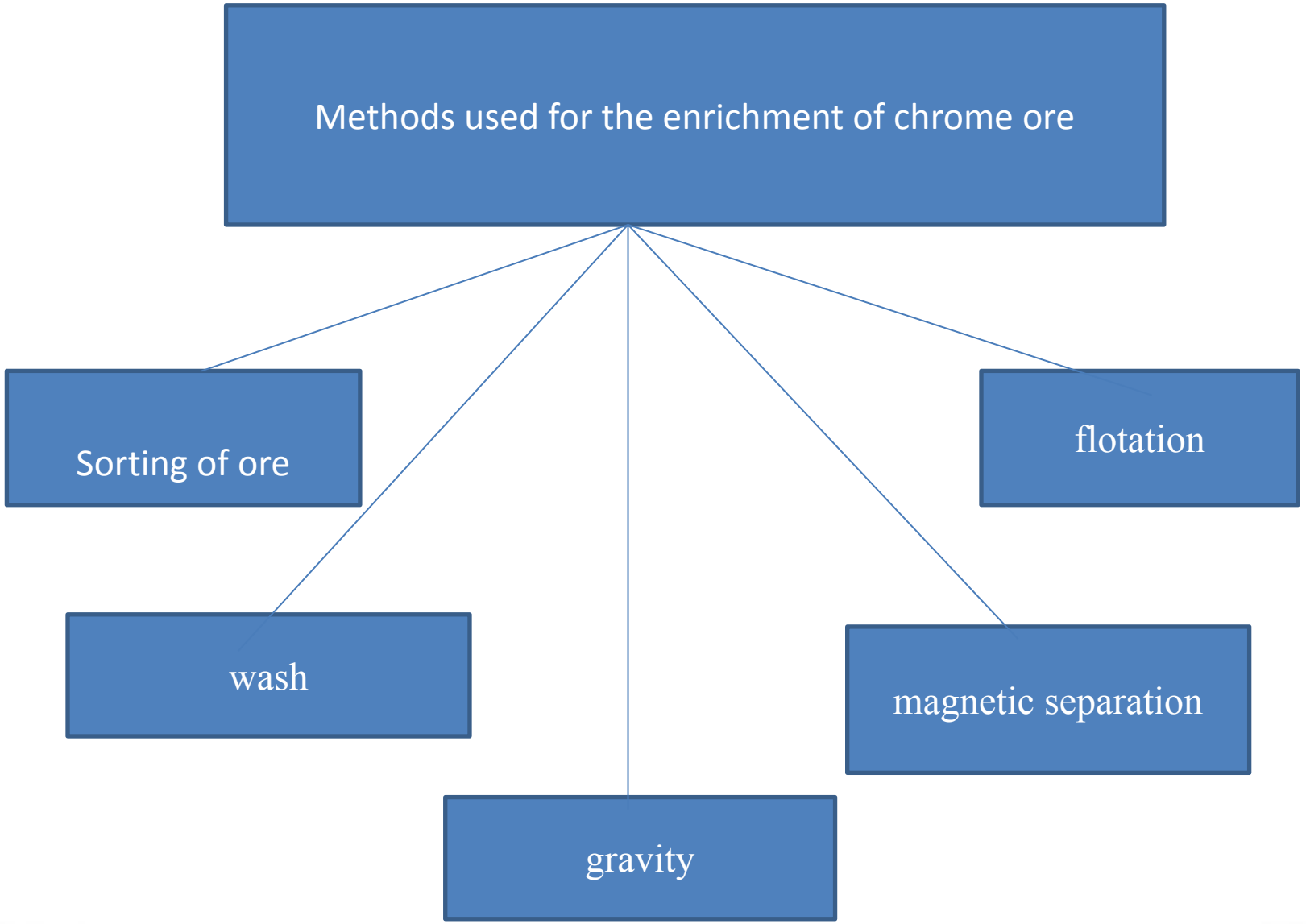
Chromium silicates

uvarovite - Ca3Cr2 (Si04) 3 chromogenate

wolkonskoite (Cr, Fc, Al)4[Si4O,0] •[OH] «2H2O.

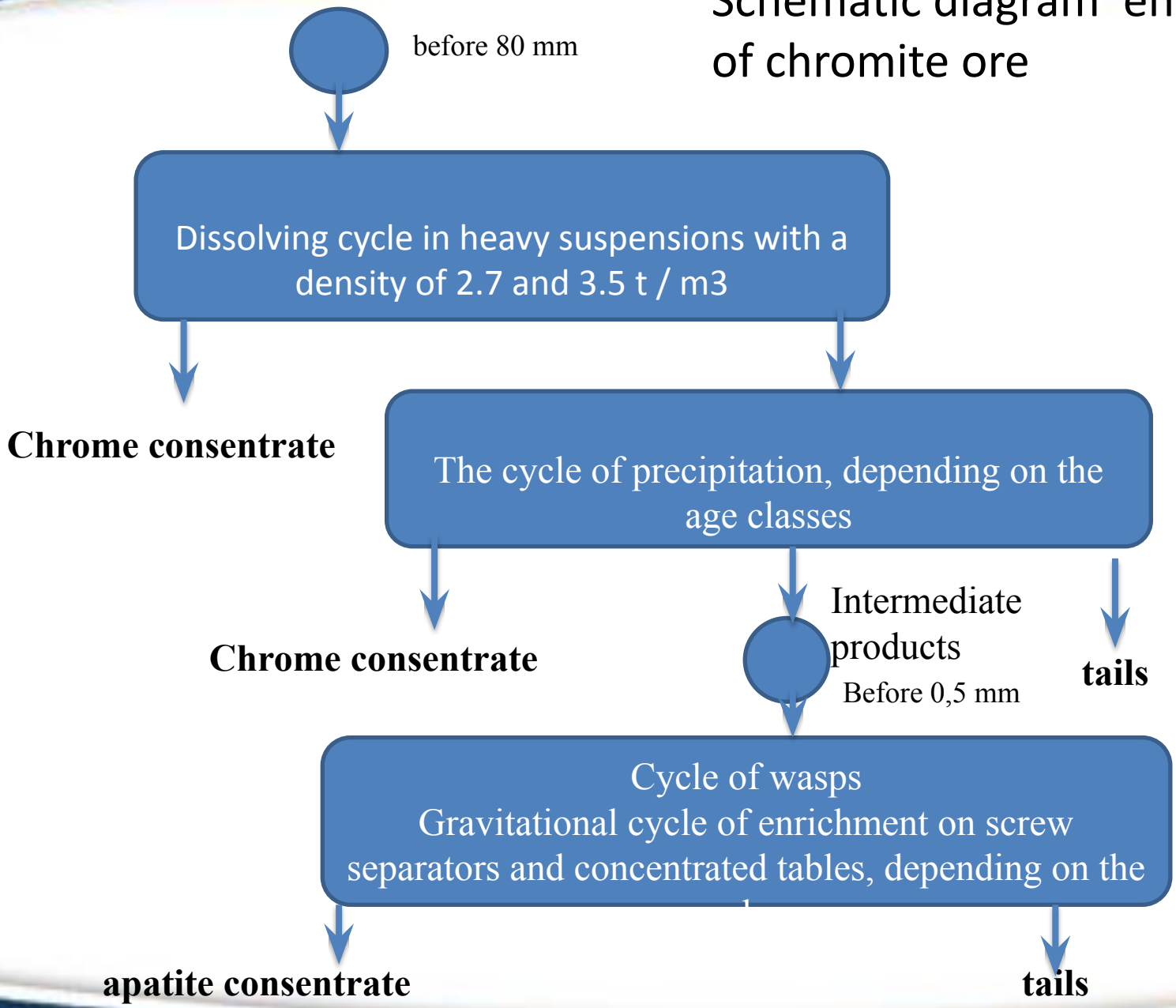
Decomposition of chromium and chromium-containing ores

- It decomposes in a mixture of salt and sulfuric acid and phosphoric acid
- melting of sodium oxide
- Potassium pyrosulfates
- burning in soda and magnesium oxide
- burning sodium and nitre
- burning in soda and nitrate
- borax

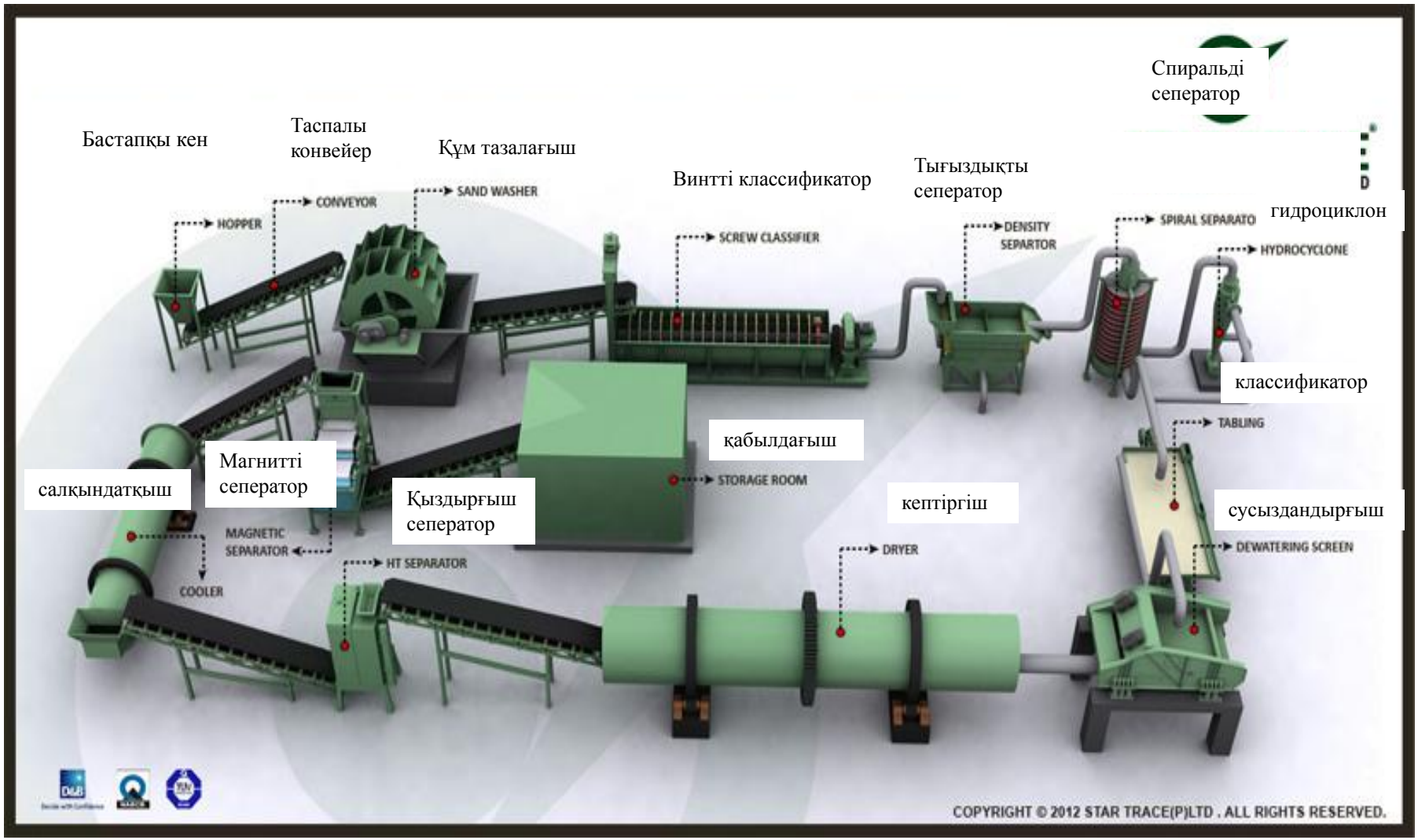

Methods used for the enrichment of chrome ore
Sorting of ore
flotation
wash
magnetic separation
gravity

Ore

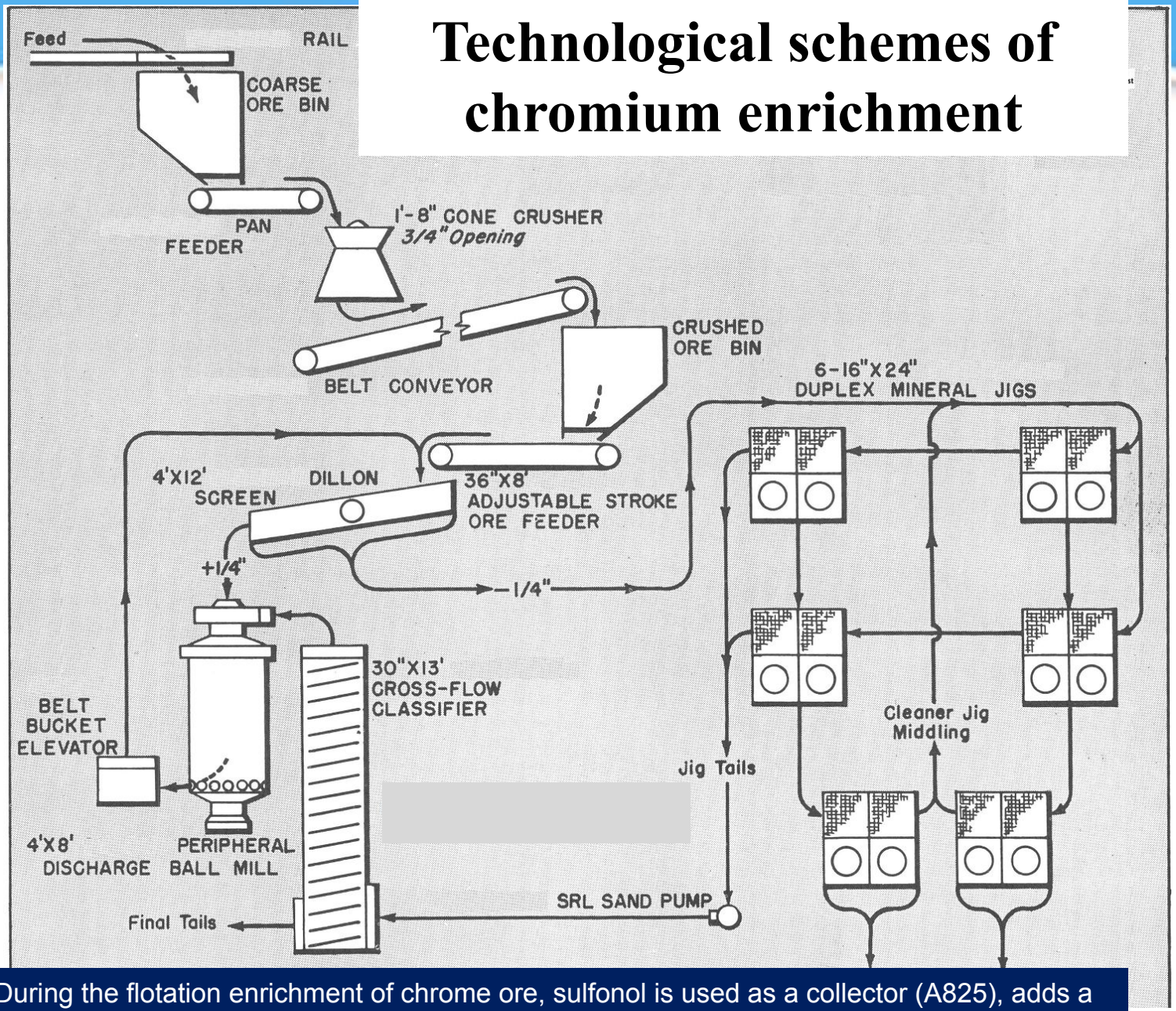
Schematic diagram enrichment of chromite ore



Technological schemes of chromium enrichment



Technological schemes of chromium enrichment



During the flotation enrichment of chrome ore, sulfonol is used as a collector (A825), adds a known amount of H_2SO_4 to control pH. In addition, the flotation reagents include dodecylamine, laureth, sodium oleate and the like are used

Requirements for the production of chrome ore.
Requirements for the chemical composition of enriched chromic concentrates in the production of ferroalloys and refractory substances

Сапа көрсеткіші	марка		
	CXD-1	CXD-2	CXD-3
Cr2O3%, not a little	48	50	50
SiO2, not a little	8,0	7,0	7,0
S, not a little	0,05	0,08	0,08
CaO, not a little	0,8	0,8	0,8
P, not a little	0,005	0,005	0,005
Cr2O3/FeOnot a little	3,5	3,6	3,6
Enlargement,mm	100-10	10-3	3-0

Requirements for the chemical composition of rich chromium ore in the production of ferroalloys and fire-resistant substances

quality indicator, %	for ferroalloy industry			for fire resistant items	
	mark			mark	
	ДХ-1-1	ДХ-1-2	ДХ-2-0	ДХ-2-1	ДХ-2-2
Cr2O3	50	47	52	50	47
SiO2	7	9	6.5	8	8
FeO2	-	-	14	14	14
CaO2	-	-	1	1	1.3
P	0.005	0.005	-	-	-
S	0.05	0.05	-	-	-
humidity	-	-	4	4	4
Cr2O3/FeO2, not a little	3.5	3	-	-	-

III. Conclusion

Having become acquainted with chrome ores in Kazakhstan and methods of their enrichment, we got acquainted with the peculiarities of these methods. Kazakhstan has a unique place in the world for the production of chromium. Our country produces high-quality chrome and its ingots. However, the production of chromium in Khromtau has its own difficulties and peculiarities. Depending on the quality of the material in the deposit and ore, the methods of enrichment vary. Therefore, one of the main goals for Kazakhstan is the development of chromium and its production of melt and the production of cost-effective products.

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