



KRASTSVETMET

# New technology boost for your refining business

Gold-silver Dore refining

# Krastsvetmet - the largest precious metals refinery in Russia

Krastsvetmet's production outlook for 2017 in Russian market:

98%	PGM	120t
66%	Gold	200t
42%	Silver	700t



# R&D Park is infrastructure for technology development and its transfer to industrial partners

## Expertise coverage:

- Hydro-, pyro-, electrometallurgy and refining
- Metalworking and industrial products manufacturing
- Environmental technologies
- Modeling and new products development
- Designing and engineering
- Chemistry and medicine
- Non-precious metals industry

**75** years  
of research experience

**8** precious metals expertise

**55** scientists  
Full-time

**61** patents  
Active now

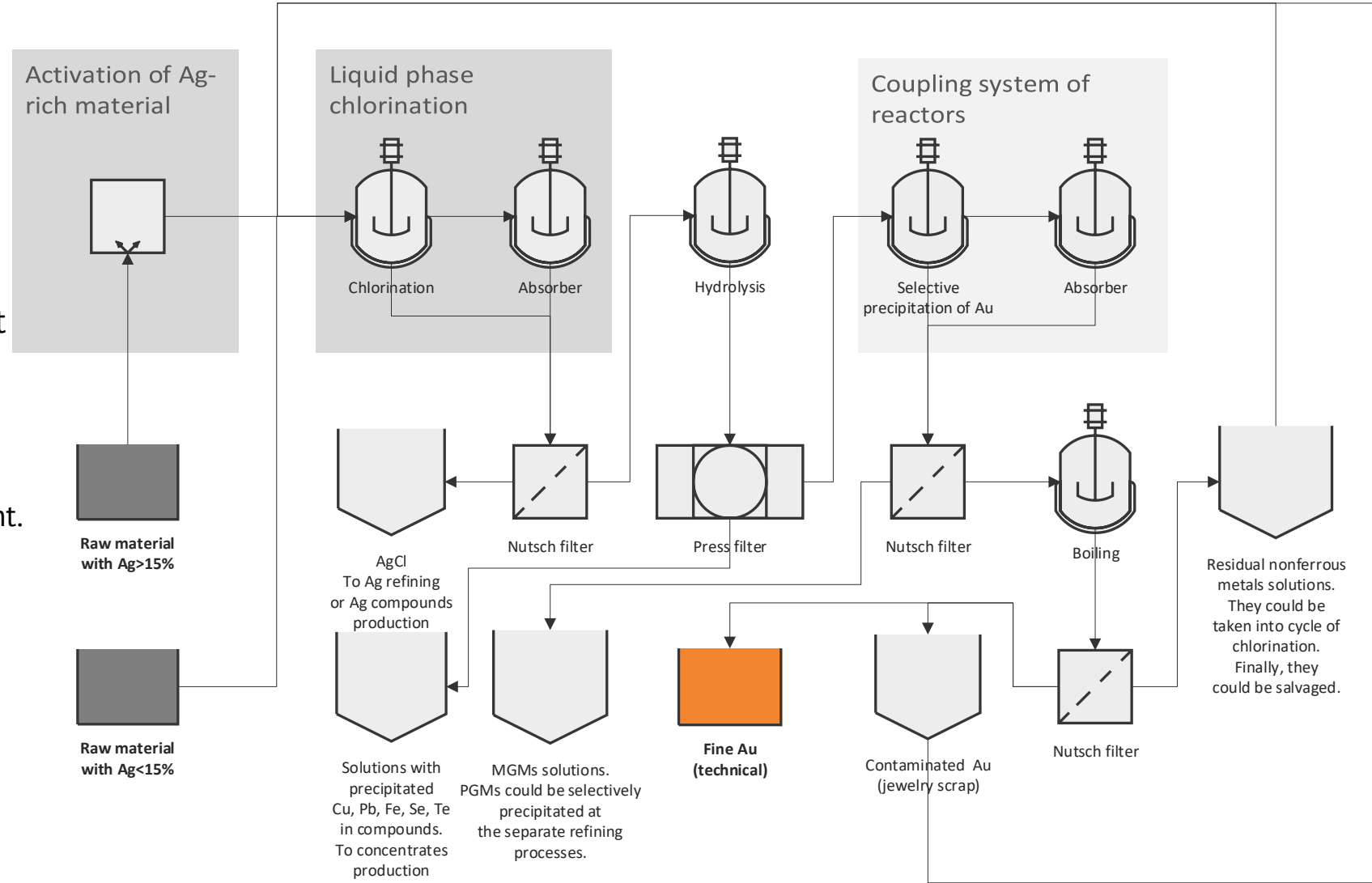


# Gold-silver Dore refining: Technologies summary

Many refineries are interested in obtaining the fine metals faster and with a high quality from the variety of materials.

We introduce Au-Ag materials refining technologies to achieve it using:

- **Activation of Ag-rich material.** A unique method of processing material with 15-70% silver content.
- **Liquid phase chlorination technology.** Faster and more effective way of raw material treatment.
- Technical setup utilizes the full efficiency of the **coupled reactors system.**



# Efficiency indicators

Implementing presented solutions today, you improve obtain extra profit and make your customers happier with the following benefits:



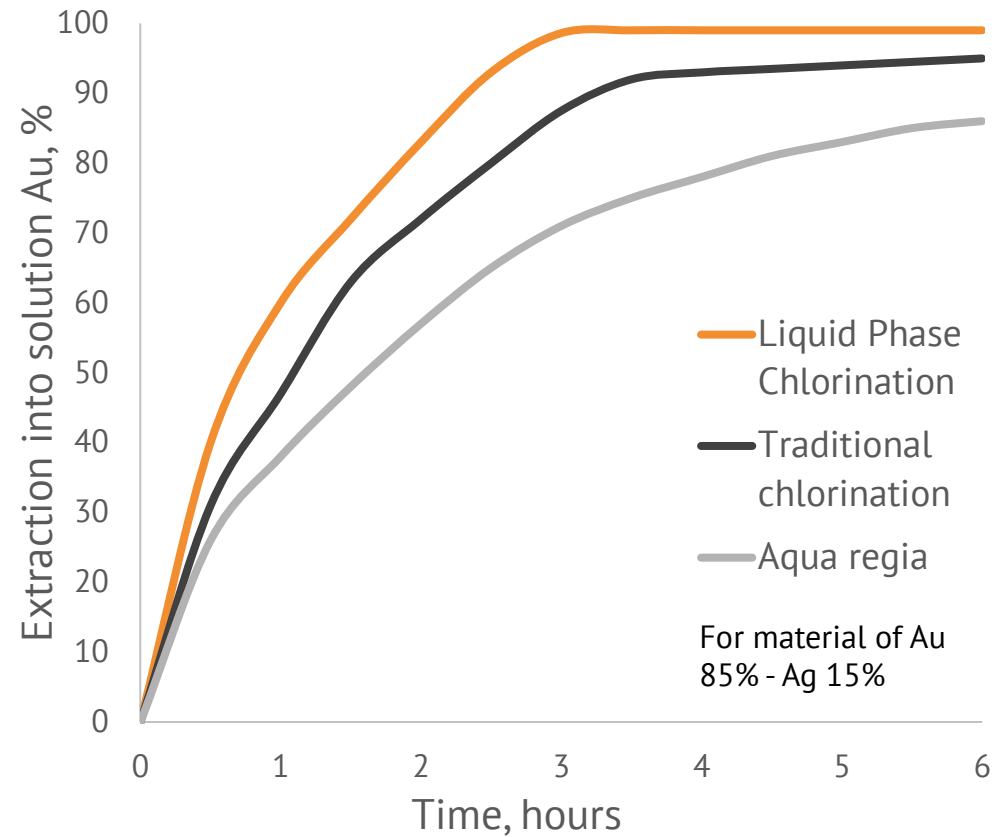
Krastsvetmet's method of activation for Ag-rich material allows you to **treat Doré (15-70% of Ag) with ease.**



Liquid phase chlorination speed up the process to only **3 hours with higher extraction** comparing to other methods shown in the graph.



Coupled tractors systems give the full control of the process and make **Cl<sub>2</sub> reacting completely** with the input material.



# Technology reference at Krastsvetmet

Krastsvetmet's R&D Park is a united team of experts with gained 75-year experience and expertise in the precious metals industry.

The presented technology of Au-Ag refining is implemented on an industrial scale at Krastsvetmet, the volume of processed raw materials is more than 100 tons.



# Engineering services portfolio supports technology life-cycle

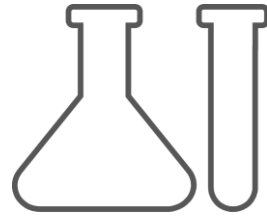


# Customer story #1: Effective solutions for rebellious material



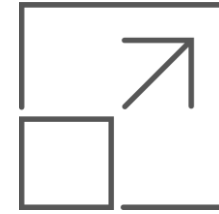
## Challenge

- Refiner struggled with rebellious material, Doré “contaminated” with Ir and Os.
- Opportunity to expand the feedstock, but traditional methods did not work



## Actions

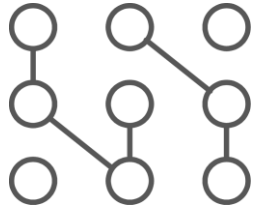
- We conducted analysis of these very products
- Ran lab scale pilot applying technologies that we use already



## Outcome

- Expansion of business was possible, with savings on CAPEX and OPEX
- New feedstock was accepted

# Customer story #2: Process optimizer for spent industrial catalyst processing



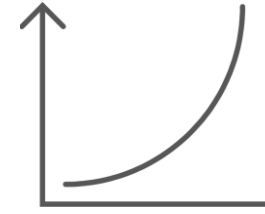
## Challenge

- Catalyst processing - 3 parallel technologies with individual constraints and benefits, 2 complement sub-contactors.
- To be considered: operational costs, lead-time and yields, equipment specifications, financing costs, sub-contractor logistics



## Actions

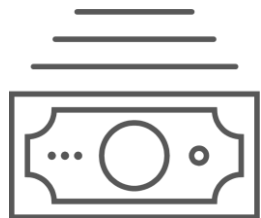
- We analyzed, digitized technological processes, utilizing mathematical modeling tools;
- Application for process optimizing was created that knows process chemistry, equipment specs, operational parameters



## Outcome

- Effective feedstock allocation was carried out unmanned and effortlessly
- Applications recorded production log, ran history analysis, generated production scenarios

# Customer story #3: Localized organometallic catalyst production



## Challenge

- Procuring from overseas catalyst manufacturers involves high shipping cost, customs duties, time
- No opportunity to customize catalyst's properties



## Actions

- We analyzed the catalytic process and developed organometallic catalyst with improved characteristics
- Transferred the technology to the local company



## Outcome

- Greenfield local production was started
- The business was expanded with savings on shipping and customs duties
- New catalyst with affordable price and increased efficiency was offered to market

# Set us a task

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