



R&D PARK

by  TMK

SCIENTIFIC AND TECHNOLOGICAL CENTER FOR HIGH-PURITY MATERIALS



"UZBEKISTAN TECHNOLOGICAL METALS COMPLEX" JSC





R&D PARK

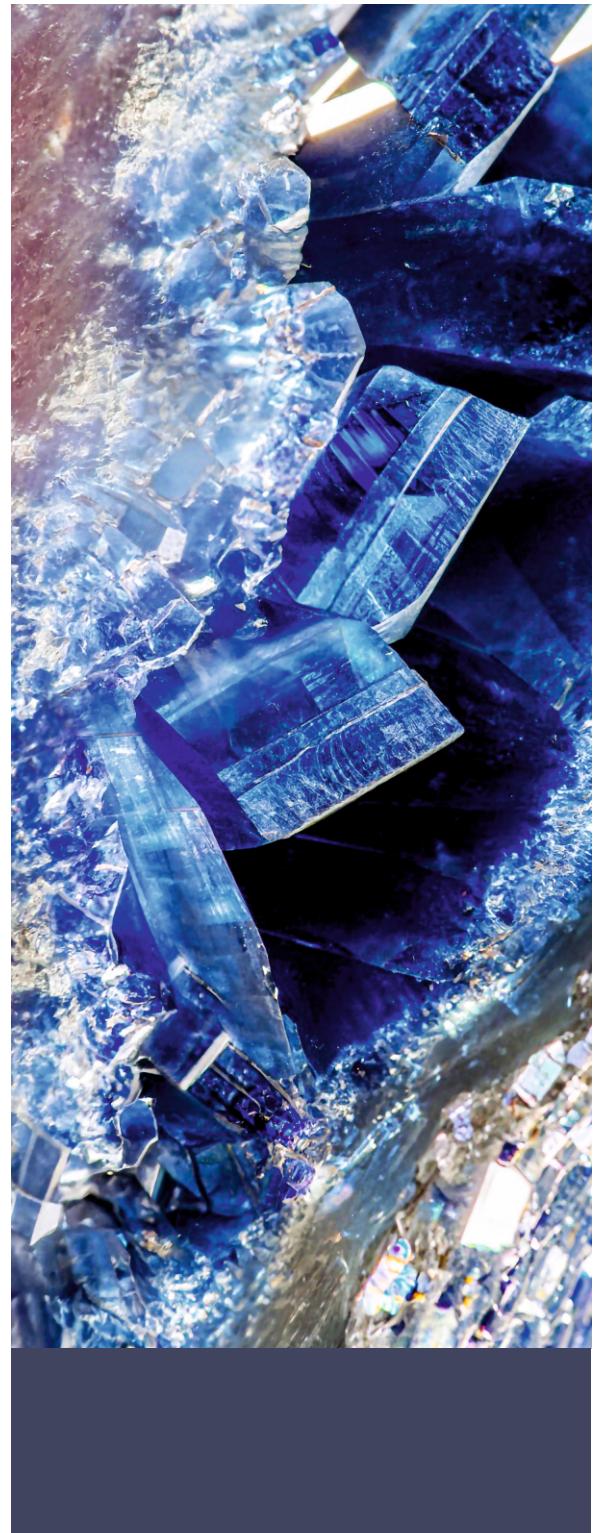
by  TMK

This is a modern research and industrial complex established on the basis of JSC "UZTMK", integrating analytical research, pilot-scale technologies, and high-purity metals production. The center includes: Central nano-analytical laboratory (up to 1,000 analyses per day); Center for additive technologies and 3D printing; Metal powder production unit; High-purity metals production (rhenium, tellurium, selenium); Testing and full-cycle технологические площадки. The project is implemented as a full-cycle system — from raw material analysis to the production of high-tech products.



FEATURE

Laboratory and pilot-scale processes





smart powder

by 

POWDER METALLURGY CLEAN TECHNOLOGY

The powder metallurgy parts production project provides for the establishment of a modern manufacturing facility for high-precision metal components for mechanical engineering and industrial equipment.

The technology is based on the pressing and sintering of metal powders without a melting stage, which makes it possible to significantly reduce energy consumption, emissions, and waste generation.

Areas of application

Mechanical engineering
Industrial equipment
Automotive industry
Robotics

Annual capacity: 50,000,000 parts/year

Part weight: 10–60 g (average 30 g)

Output: approx. 1,500 t of finished products/year

Products: valve seats, valve guides, sprockets

Applications: internal combustion engines, transmissions

Key environmental indicators

Annual metal savings (PM vs. casting): 480 t/year

CO₂ emissions reduction (PM vs. casting): 2,100 t CO₂/year

Metal utilization rate — PM: >97%

Metal utilization rate — casting + machining: 65–75%

smart powder

by TMK

| ESG Indicators | Casting + machining | Powder metallurgy (PM) | Advantages of Powder Metallurgy (PM) / Differences |
|----------------|---------------------|------------------------|--|
|----------------|---------------------|------------------------|--|

Material Utilization Efficiency

| | | | |
|---|--|--|---|
| Metal Utilization Rate | 65–75% 25–35% is removed as machining chips during machining operations | 97% Near-net-shape form; minimal finishing operations after sintering | +22–32 percentage points improvement ~480 t/year metal savings |
| Metal Waste Generation (at 50 million parts/year) | ≈ 530 t/year Cast iron/steel chips + gating systems + risers | ≈ 45 t/year Recyclable coarse powder and calibration machining chips | –485 t of waste/year Elimination of waste and energy required for remelting of chips |
| Annual raw material requirement | ≈ 2 030 t/year | ≈ 1 545 t/year | –485 t/year of raw material requirement |

Energy consumption and carbon emissions

| | | | |
|---|--|--|---|
| Maximum process temperature | 1,250–1,450 °C Full melt in an induction furnace or cupola furnace | 1,080–1,180 °C Solid-state sintering; full melting is not required | 200–300 °C lowerSignificant reduction in heat losses |
| Specific energy consumption per tonne of product | 18–24 GJ/t Melting + holding + electricity for machining operations | 11–15 GJ/t Pressing + sintering; no energy required for melting | ≈ 35–40% energy savings per tonne |
| Direct CO ₂ emissions Scope 1 (per year) | ≈ 3,650 t CO ₂ /year Natural gas/coke combustion in furnaces; ~1.8 kg CO ₂ /kg metal | ≈ 1,545 t CO ₂ /year Electric sintering; ~1.0 kg CO ₂ /kg based on average grid energy mix | –2,100 t CO ₂ /year Greater reduction with transition to renewable energy sources (RES) |

| ESG Indicators | Casting + machining | Powder metallurgy (PM) | Advantages of Powder Metallurgy (PM) / Differences |
|----------------|---------------------|------------------------|--|
|----------------|---------------------|------------------------|--|

Water consumption and consumables

| | | | |
|---------------------------|--|---|--|
| Process water consumption | High: ~8-12 L/kg of product Cooling of molds, quenching, cutting fluids during machining operations | Low: ~1-2 L/kg of product Dry pressing + sintering; water is used minimally or not required in the main process stages | ≈ 70-80% water savings per kg of product |
|---------------------------|--|---|--|

Waste and circular economy

| | | | |
|-------------------------------|---|--|---|
| End-of-life product recycling | Good: cast iron/steel are fully recyclable after the engine reaches end of life | Good: sintered iron/steel are fully recyclable; comparable scrap value | Equivalent both routes are fully recyclable |
|-------------------------------|---|--|---|

Social and governance aspects

| | | | |
|----------------------------------|---|--|--|
| Yield rate and process stability | 70-85% first-pass yield Porosity, inclusions, and dimensional defects are common | 92-98% first-pass yield Consistent pressing density; predictable shrinkage during sintering | Higher yield → lower rework energy consumption and reduced waste |
|----------------------------------|---|--|--|

Summary Table — Quantitative Indicators (PM vs Casting + Machining)

| Indicators | Casting + machining | Powder metallurgy (PM) |
|---|---------------------|------------------------|
| Raw Material Requirement (t/year) | 2 030 t | 1 545 t |
| Metal Waste Generation (t/year) | 530 t | 45 t |
| CO ₂ Emissions (t CO ₂ /year) | 3 650 t | 1 545 t |
| Specific Energy Consumption (GJ/t of product) | 21 GJ/t | 13 GJ/t |
| Water Consumption (approx., per year) | 22 GJ/t | ~4 kL |
| First-Pass Yield (%) | 77% | 95% |

DIGITAL ECOLOGY

As part of the implemented projects, the introduction of modern digital solutions in environmental management, monitoring, and production analytics is envisaged.

SITUATIONAL ENVIRONMENTAL CENTER

- monitoring of emissions, water consumption, wastewater, and waste
- integration of environmental data from all projects into a unified control system
- real-time analytics, visualization of indicators, and reporting generation
- improved speed of managerial decision-making



LOCAL AI ASSISTANT (RAG) / CORPORATE KNOWLEDGE SYSTEM

A local intelligent assistant with a scalable knowledge base is being deployed within the enterprise infrastructure, providing:

- search and processing of information across all internal corporate documentation
 - generation of responses to production, environmental, and regulatory queries
 - assistance in preparing reports, letters, certificates, and analytical materials
 - data analysis, detection of deviations, and identification of potential risks
- The system operates entirely within the internal corporate environment, with no data transfer to external information systems

**ANALYSIS → TECHNOLOGY →
PRODUCT → CONTROL
MODERN GREEN INDUSTRY**