



BREST STATE TECHNICAL UNIVERSITY

PROMISING TECHNOLOGIES FOR HARDENING AND RESTORING MACHINE PARTS AND ELEMENTS OF TECHNICAL STRUCTURES

PhD, D.Sc. Mikhail NIARODA

First vice-rector of educational establishment
"Brest State Technical University"

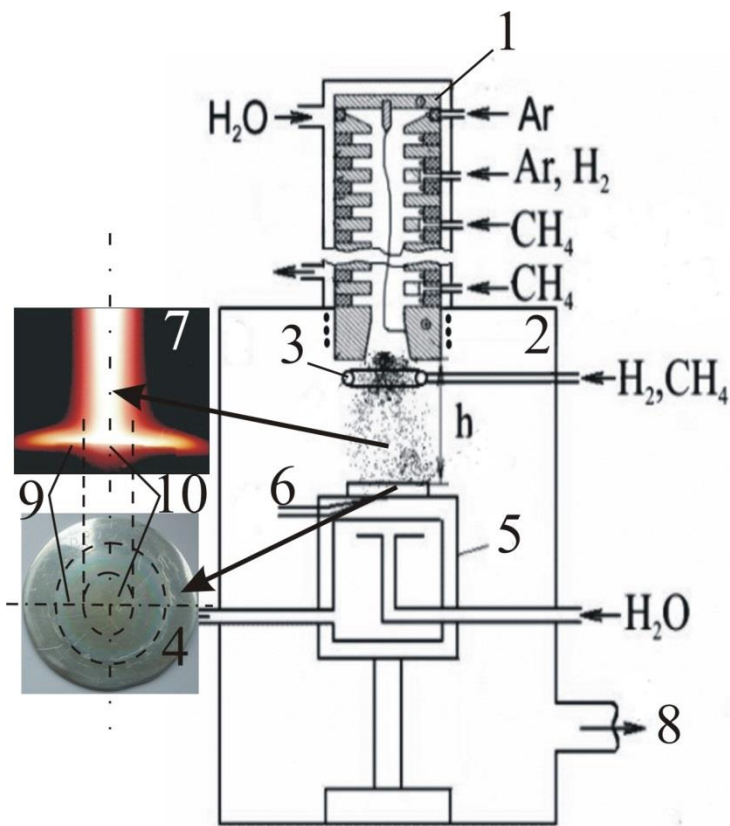
Prof. Dr. Oleg DEVOINO, PhD, D.Sc.

Head of the Industry Research Laboratory of
Plasma and Laser Technologies of Belarusian
National Technical University's branch
"Research Polytechnic Institute"



BREST STATE TECHNICAL UNIVERSITY

Application of carbon and diamond-like films



- 1 – plasma cutter with interelectrode insert
- 2 – chemical reactor
- 3 – ring for gas supply to the reactor
- 4 – wafer-plate photo
- (9 – peripheral / 10 – central area)
- 5 – water-cooled wafer-plate holder
- 6 – thermocouple
- 7 – photo supersonic plasma jet
- 8 – pumping post



BREST STATE TECHNICAL UNIVERSITY

Application of carbon and diamond-like films

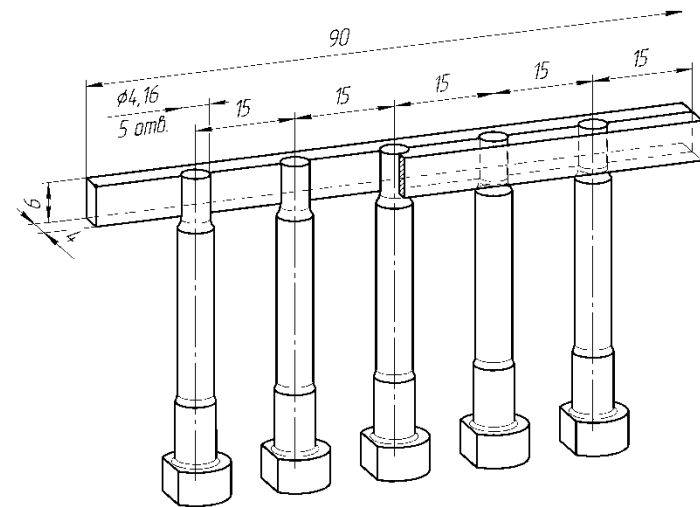




Surface Plasma Hardening



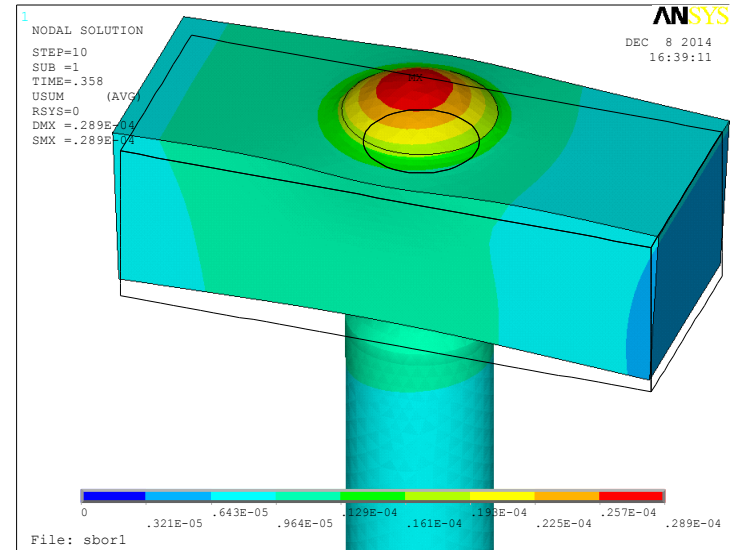
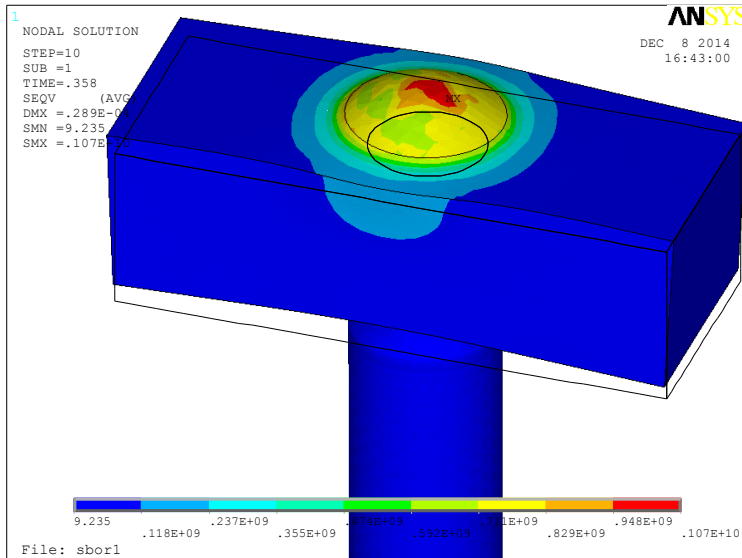
Hardened knife for processing wood waste



Device for surface plasma hardening of punches and intensive heat removal into copper plates

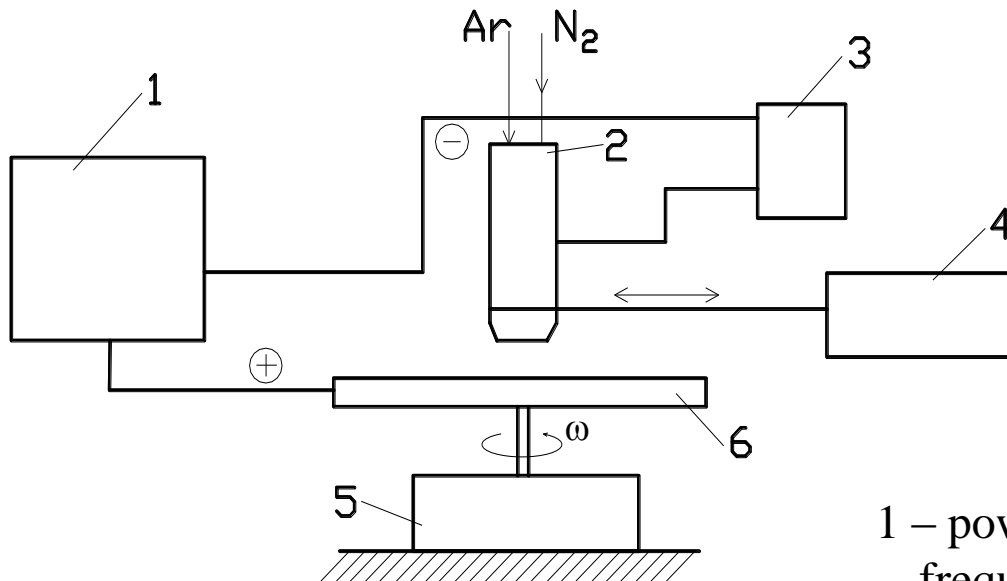


Surface Plasma Nitriding



Some results of Stress-strain state study in surface plasma hardening and intensive heat removal using the ANSYS software package

Surface Plasma Nitriding



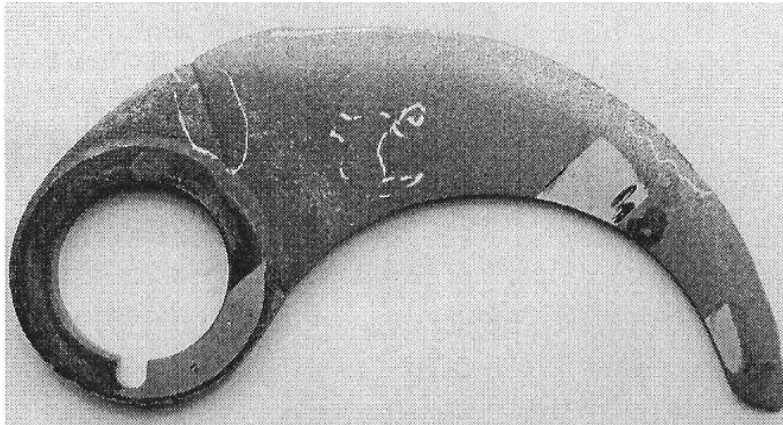
Installation scheme

1 – power supply; 2 – plasma cutter; 3 – high frequency generator; 4, 5 – manipulators; 6 – hardened part

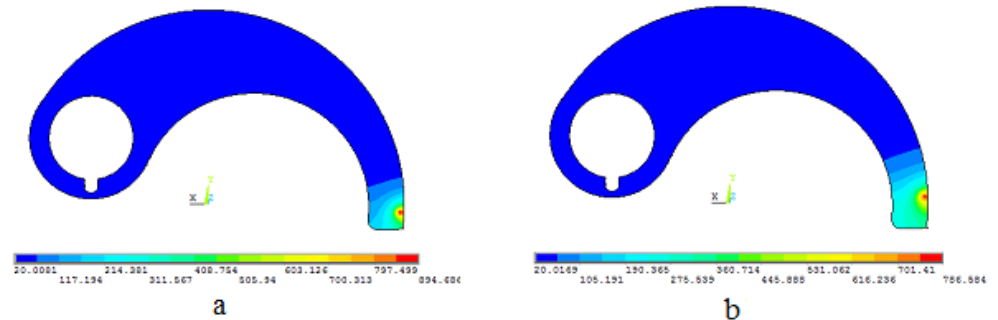


BREST STATE TECHNICAL UNIVERSITY

Surface Plasma Nitriding



Blade for cutting meat products



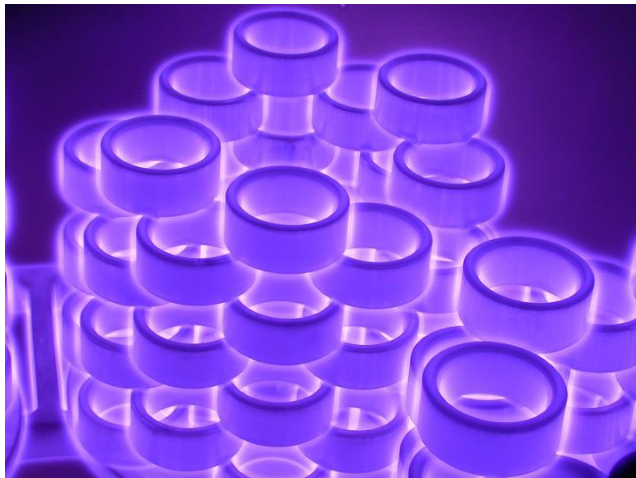
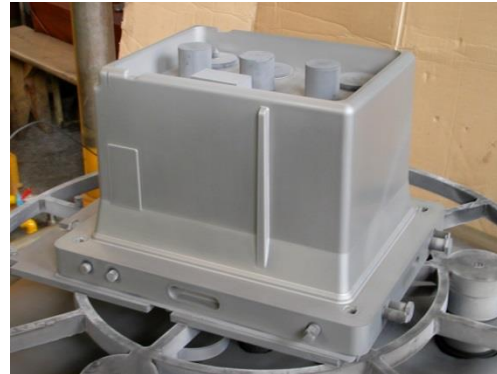
Distribution of the temperature field on the surface of the blade for different moments of time

a – $t=1$ sec., b – $t=2$ sec.



BREST STATE TECHNICAL UNIVERSITY
**STATE SCIENTIFIC INSTITUTION "PHYSICAL-
TECHNICAL INSTITUTE OF THE NATIONAL
ACADEMY OF SCIENCES OF BELARUS"**

Ion-plasma nitriding





BREST STATE TECHNICAL UNIVERSITY
STATE SCIENTIFIC INSTITUTION "PHYSICAL-TECHNICAL INSTITUTE OF THE NATIONAL ACADEMY OF SCIENCES OF BELARUS"

Ion-plasma nitriding



Crankshafts



Shafts for the manufacture of metal tiles



BREST STATE TECHNICAL UNIVERSITY
STATE SCIENTIFIC INSTITUTION "PHYSICAL-TECHNICAL INSTITUTE OF THE NATIONAL ACADEMY OF SCIENCES OF BELARUS"

Ion-plasma nitriding



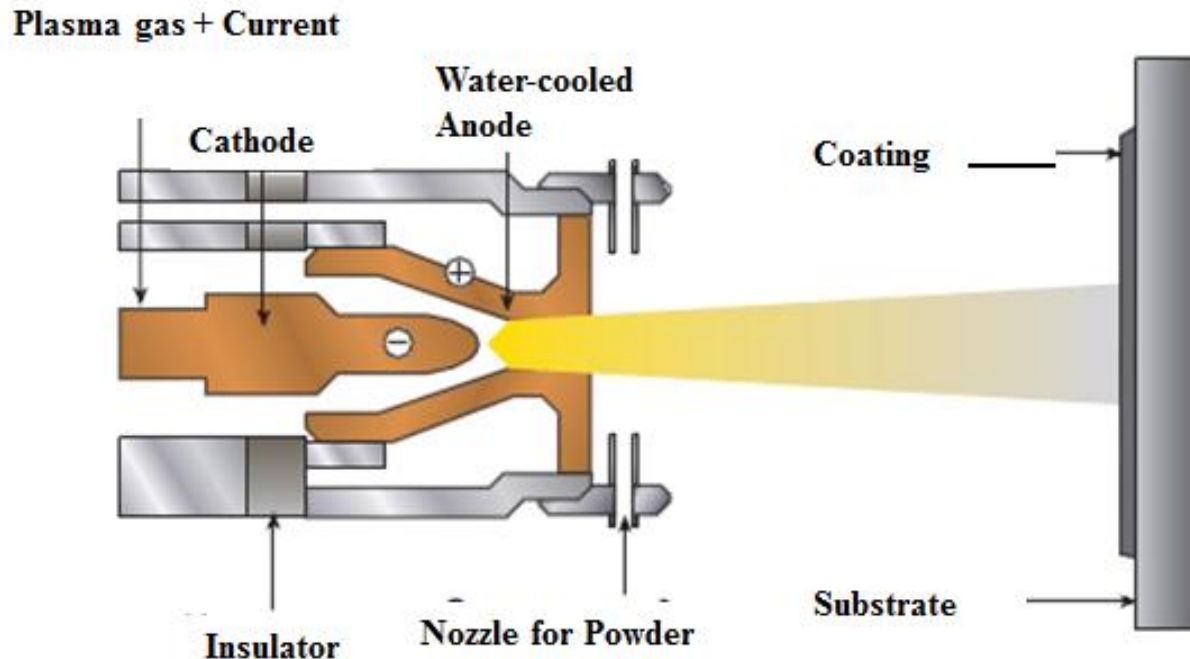


BREST STATE TECHNICAL UNIVERSITY

BELARUSIAN NATIONAL TECHNICAL UNIVERSITY

Plasma spraying technology of powdered materials

Scheme of Plasma Deposition of Powder Materials





BREST STATE TECHNICAL UNIVERSITY

BELARUSIAN NATIONAL TECHNICAL UNIVERSITY

Plasma and Gas-flame Spraying



Gas-flame spraying of shafts' support surfaces



BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Plasma and Gas-flame Spraying



Shaft of compressor



Bandage for wire drawing



**Disk for transmission of heavy
tractors**



Spiral shaft (JSC «Belaruskaly», Soligorsk)



**Spiral shaft for metal-polymer magnetic
powder**



BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Gas-flame spraying and gas-powder cladding of ground-digging parts



Ground-digging disk



Parts for corn's seeder



Ploughshare



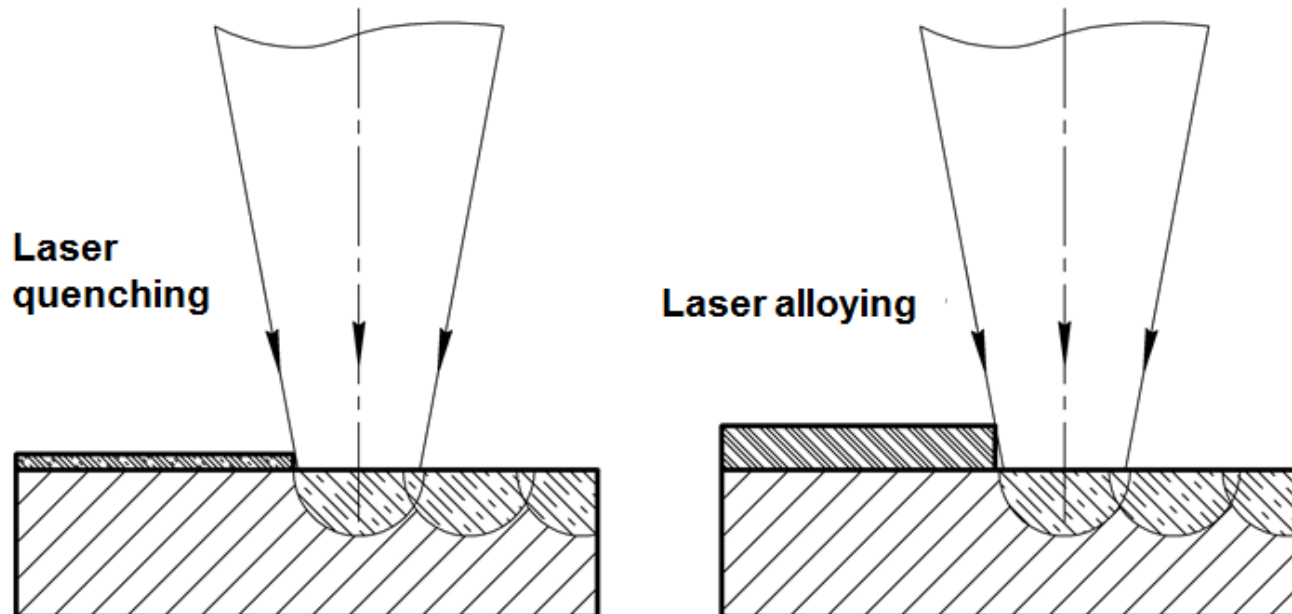
BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Laser hardening

Types of laser surface treatment





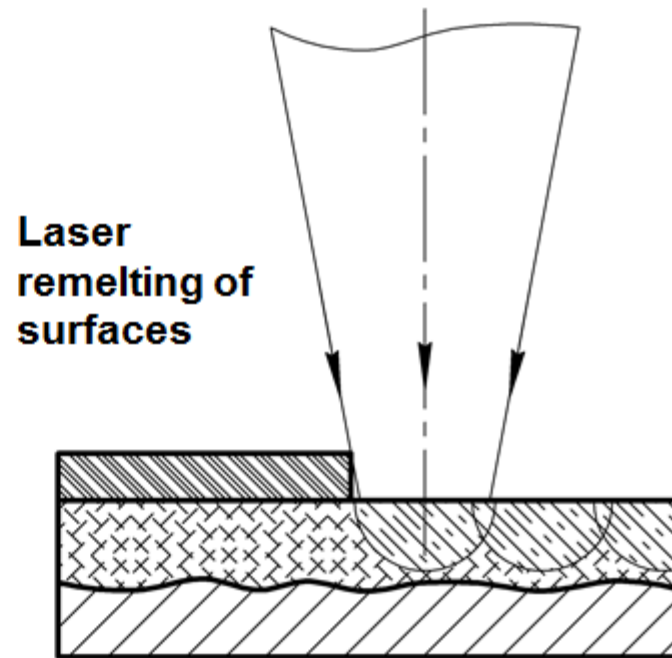
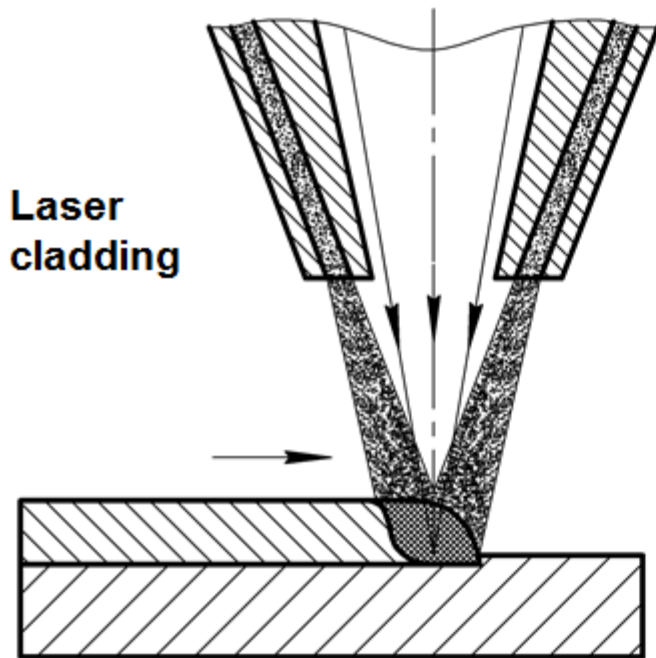
BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Laser hardening

Types of laser surface treatment





BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Laser hardening

Parts of heavy truck BelAZ hardened by laser quenching





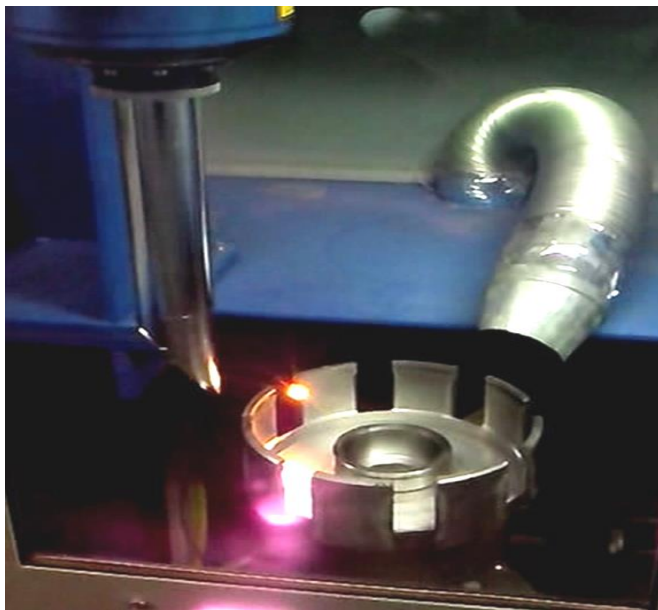
BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Laser hardening

Shop for strengthening parts of breaking and friction mechanisms of tractor “Belarus”





BREST STATE TECHNICAL UNIVERSITY



**BELARUSIAN NATIONAL TECHNICAL
UNIVERSITY**

Thank you for attention!