



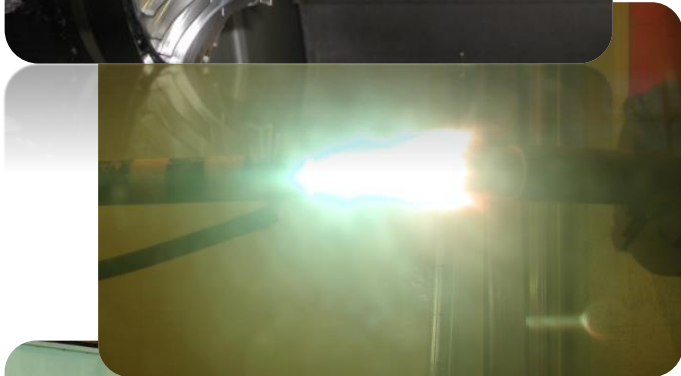
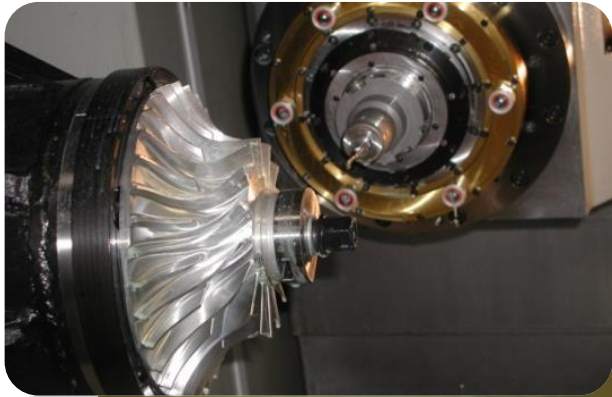
**National Aerospace University
"Kharkiv Aviation Institute"**

**Protective coatings spraying / machining
technologies and special equipment
for industrial applications**





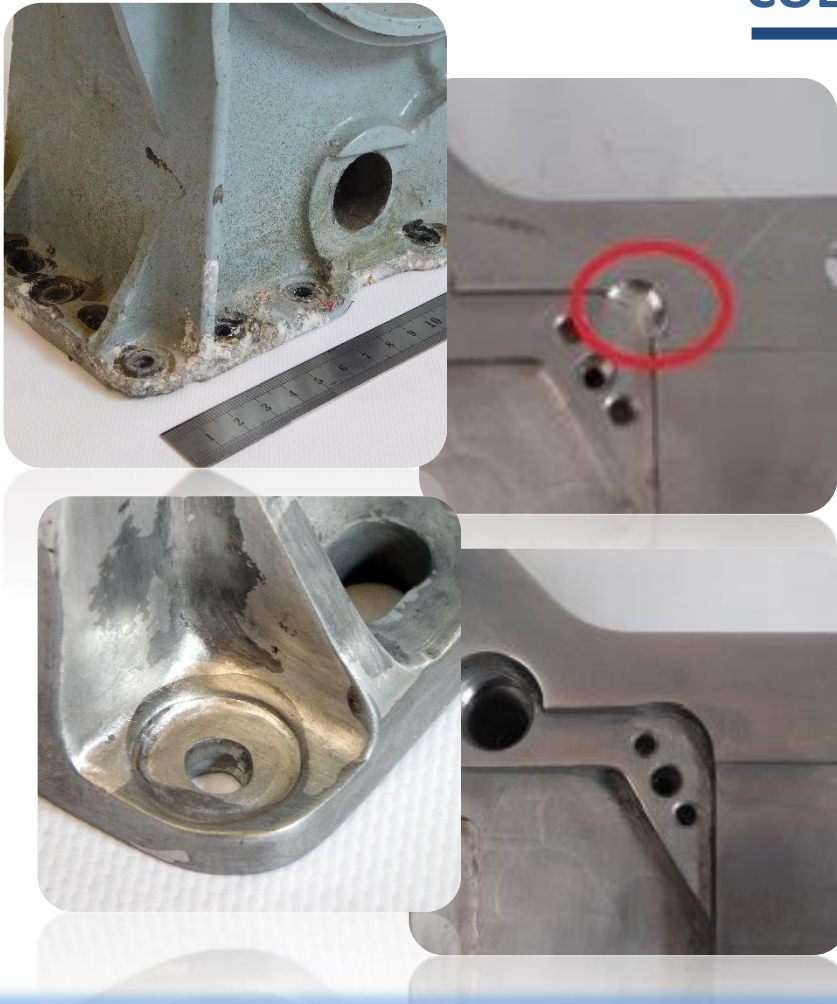
1. KHAI prospective collaboration ways: MANUFACTURING AND REPAIR TECHNOLOGIES



1. Special technologies for non-defect treatment of aircrafts and engines' parts made of hard-to-machined materials (planetary deep grinding technology, magnetic-abrasive technology etc.)
2. Special technologies of surface hardening of aircrafts and engines' parts (physical-chemical methods, surface plastic deformation technologies etc.)
3. Protective and restorative coatings (cold spraying, gas-detonation spraying, vacuum technologies etc.) for increasing of a life cycle.
4. Technologies of composite material parts manufacturing with special pre-set physical properties (thermal conductivity, electrical conductivity etc.)



2. KHAI prospective collaboration ways: **COLD SPRAYING TECHNOLOGY - ADVANTAGES**



- The technology has no match at prime cost of spraying coverings, simplicity of service (both in the conditions of the enterprise, and in field conditions) and ecological safety.
- The method allows to receive coverings from metals (Al, Zn, Cu, Ni, Co, Fe, Ti, V, Sn, etc.), alloys and also their mechanical mixes (including, powders of oxides, WC etc.).
- The technology provides coverings practically without heating of a substrate applying the inert gases.
- No oxidation. The possibility of spraying coverings on the thin-wall details.
- The technology provides coverings up to 10 mm thick and porosity of 1-3%.
- High adhesive durability (30 - 80 MPa) allows machining coverings.



3. KHAI prospective collaboration ways: COLD SPRAYING TECHNOLOGY – KHAI SERVICES

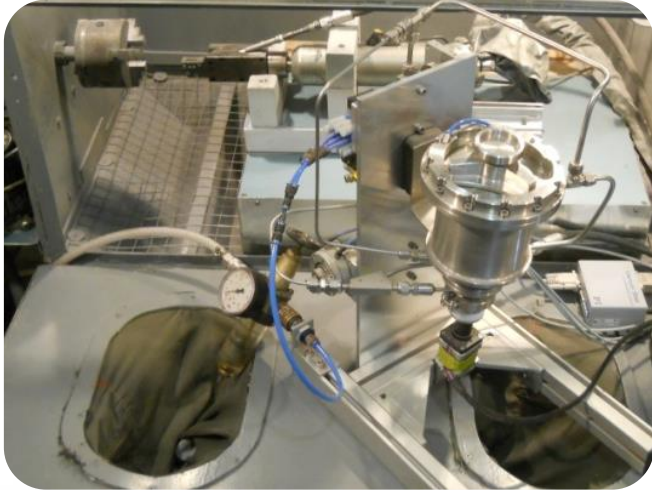


KHAI proposes a full range of services in the field of development / modernization of the equipment and technologies for CS:

- Analysis of operating conditions of products and appearance of defects
- Development of recommendations concerning protection / restoration of products
- Modeling and optimization of parameters of spraying process
- Carrying out the natural experiments and definition of coverings' characteristics
- Development of technological processes of coating
- Modernization / production of low and average pressure systems .



4. KHAI prospective collaboration ways: **COLD SPRAYING TECHNOLOGY - DEVELOPMENTS**



Production and testing of modules of average/high pressure systems:

1. Areas of working pressure: 8 ... 60 atm.
2. Working temperatures of gases: 180 ... 940 C
3. The opportunity of optimization of a flowing part for powders coating of various structure and dimensions.
4. Development of short nozzles (less then 45 mm) for spraying of internal surfaces



KHAI provides development, manufacturing, testing of powder feeders, electrical heaters, optimized nozzles etc.



5. KHAI prospective collaboration ways: GAS-DETONATION TECHNOLOGY - ADVANTAGES



Features of process:

- high density (180 MPa) of the received coverings;
- speed of the sprayed particles – up to 1000 m/s;
- wide nomenclature of sprayable materials and materials of a substrate (metal, ceramics, plastic, glass, wood);
- high profitability of process;
- insignificant thermal impact on a substrate;
- any form of a surface for spraying (the requirement to an inclination to a stream of particles – at an angle more than 45°);
- it is possible the coating of substrates less than 1 mm thick.



6. KHAI prospective collaboration ways: GAS-DETONATION TECHNOLOGY - APPLICATIONS



Gas-turbine engines: Blades and midspan damper of compressors and turbines, Lever turn of blade's , limit stop, locking devices

Aviation industry: Cases of gas turbines steps, CHP pro-rate aircraft engines; covers of support, leading gear wheel of free turbines, nozzle device of II step of helicopter engines turbine

Engineering: water-wheel rotor (hardening and restoration of the mounting seat for bearings and gear wheels), locking equipment (hardening and restoration), mechanical seals at the output spindles of mining machines, press molds for pressure die casting

Automobile industry: pistons tops and combustion chamber area, Cam-shafts, tappet arm, terminals, piston ring groups (hardening and restoration), crankshaft kit (hardening and restoration).



7. KHAI prospective collaboration ways: MULTI-LAYER NANO-SCALED COATINGS - APPLICATIONS

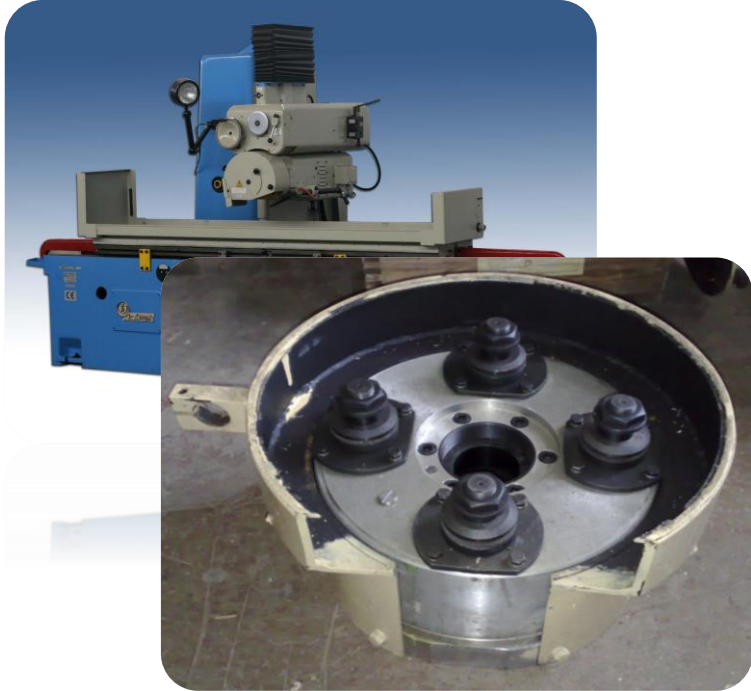
Protective and restorative coatings for GTE parts (vacuum technologies) for increasing of engine life cycle:

- Erosion-resistant
- TBC
- Photo chromic
- Hardening





8. KHAI prospective collaboration ways: TECHNOLOGY OF THE HIGH-SPEED DEEP GRINDING

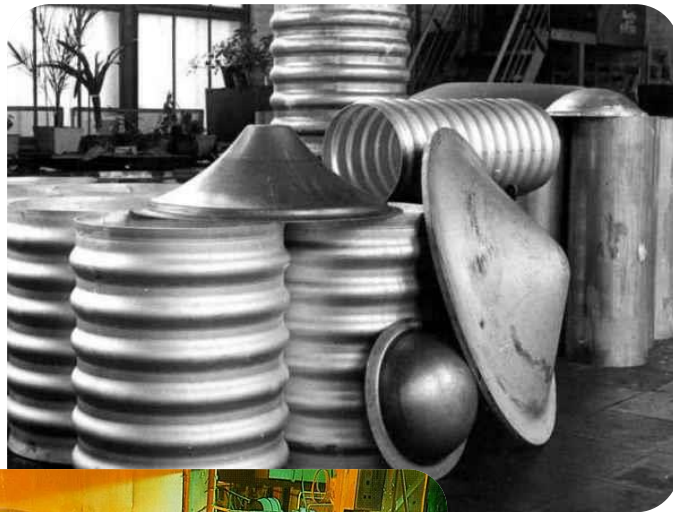


Special grinding technology for treatment of heat resisting and high-temperature nickel-chromium alloys, the titanic alloys, chilled cast iron, magnetic alloys etc., excludes grinding burns formation.

- The method allows to machine a part by usual abrasive wheel on ceramic basis with speed of grinding up to 45-60 mps at all (any) depth of allowance.
- It forms compression residual stresses in a superficial zone at depth of 50-115 microns.
- The method reduces power intensity of process in 2-4 times.
- The method allows to raise productivity of machining in 2-5 times in comparison with usual technology of deep grinding.
- It allows to decrease consumption of cutting emulsion in 5-9 times.
- It allows to decrease heat-intensity of process in 7-10 time and to exclude the probability of grinding rejects.



9. KHAI prospective collaboration ways: FAST FORMING TECHNOLOGY AND EQUIPMENT



KhAI is the leader in designing of industrial technologies and equipment for sheet extrusion by detonating, hydro-percussion and electro-hydraulic extrusion, high-speed metals cutting and volumetric extrusion. The thickness of walls: from 0,1 mm.

