V. N. Bakul INSTITUTE for SUPERHARD MATERIALS of NAS of UKRAINE
Department (#20) Perspective Resource-Saving Technologies of Machining

Who we are

Department #20 "Perspective resource-saving technologies of machining" is structural division of V.N. Bakul Institute for Superhard Materials.

The scientific and applied interests include developing of the theory and application of resource-saving processes of cutting and cold plastic deforming (the CPD) for improving of functional and working behavior of hardware, geometrical and mechanical properties of surface layer; shaping processes for surfaces of an intricate profile at gears, spline drives, ball joints, and also a medical implants by tools from superhard and other advanced tool materials.

In particular, researches are directed on:

- ✓ developing of the theory and practice of perspective resource-saving processes of cutting and the CPD by tools from super-hard and other advanced tool materials;
- ✓ developing of the scientific basic of improving of a resource of a hardware by the CPD, including:
  - creating of surfaces of an intricate profile in article of type 'bush' by reducing method;
  - creating of a gradient structures (small-grained and/or nano-sized) in surface layer of materials including titanium and its alloys;
  - engineering of surface layer of materials, including titanium and its alloys, by a combination of the CPD and thermal diffusion saturation by penetration elements;
  - compacting of powder materials with necessary porosity by the localized step CPD into closed space;
- ✓ developing of the scientific basic for diamond machining of a medical implants from advanced materials (sapphire, biologically inert ceramics and metal alloys), including joint components for endoprostheses of joints in order to improve its working life;
- ✓ developing of the scientific basic of creating of the surfaces of an intricate profile at gears, spline drives and another hardware by cutting and/or deforming tools.

Collaboration interests

We are interested in collaboration at EU level in the next R&D field:

- ✓ improving of a resource of a hardware;
- ✓ creating of surfaces of an intricate profile in article of type 'bush' by reducing method;
- ✓ creating of a gradient structures in surface layer of materials;
- ✓ engineering of surface layer of materials;
- ✓ control of porosity for compacted powder materials;
- ✓ improving of working life for a medical implants from advanced materials, including joint components for endoprostheses of joints;
- ✓ creating of the surfaces of an intricate profile at gears, spline drives and another hardware by cutting and/or deforming tools.

Research Areas

We are researching in the next R&D field:

- ✓ improving of a resource of hardware by the CPD;
- ✓ creating of surfaces of an intricate profile in article of type 'bush' by reducing method;
- ✓ creating of a gradient structures in surface layer of materials including titanium and its alloys;
- ✓ engineering of surface layer of materials, including titanium and its alloys, by combination of the CPD and following thermal diffusion saturation by penetration elements;
- ✓ control of porosity for compacted powder materials after the localized step CPD into closed space;
- ✓ improving of working life for a medical implants from advanced materials including joint components of endoprostheses of joints;
- ✓ creating of the surfaces of an intricate profile at gears, spline drives and another hardware by cutting and/or deforming tools.

Main achievements

- ✓ Radial compacting method by means of the localized step CPD into closed space was created for decrease of porosity from 30% to 5% at long-length (5…10 diameters) sleeves from powder materials
- ✓ Technologies was developed for creating of spherical surfaces at medical implants of type 'truncated ball':
  - on sapphire and biologically inert ceramics with non-sphericity < 1 μm and roughness *Ra*<0,02 after diamond machining;
  - on pure titanium with non-sphericity < 3 μm and roughness *Ra*<0,04 after a combination of surface strain hardening and diamond machining;
- ✓ To create gears of any profile by worm, disk-shaped or rack tools were proposed due to developing of theoretical basic, new cinematic scheme and technological ways.

Reference projects

- ✓ STCU international (with Kharkov Institute for Single Crystals and Georgian Technical University) project #3596 "Influence of Anisotropy of Crystal Lattice On Workability and Quality of Medical Sapphire Implants" 2006-2007.
- ✓ STCU international (with Kharkov Institute for Single Crystals and Georgian Technical University) project #4596 "Development of methods for hardening of sapphire used in medicine" 2009-2010.

Contact information

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What makes us a good partner

All our researchers have wide experience on resource-saving machining processes research areas

We have close co-operation with industry of Ukraine

All our researchers have MSc or PhD degrees

All our researchers have at least 10 year experience in their domain