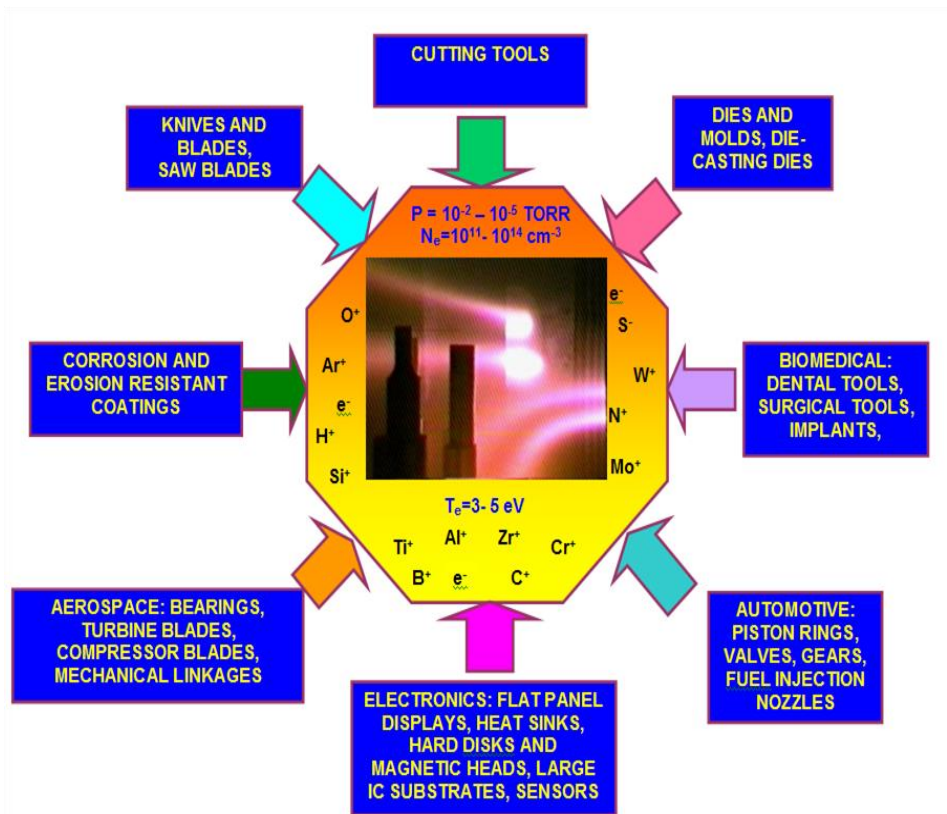




# Nano-Product Engineering

[www.nanoproductengineering.com](http://www.nanoproductengineering.com)

## Providing Advanced Surface Engineering Solutions for Demanding Applications:



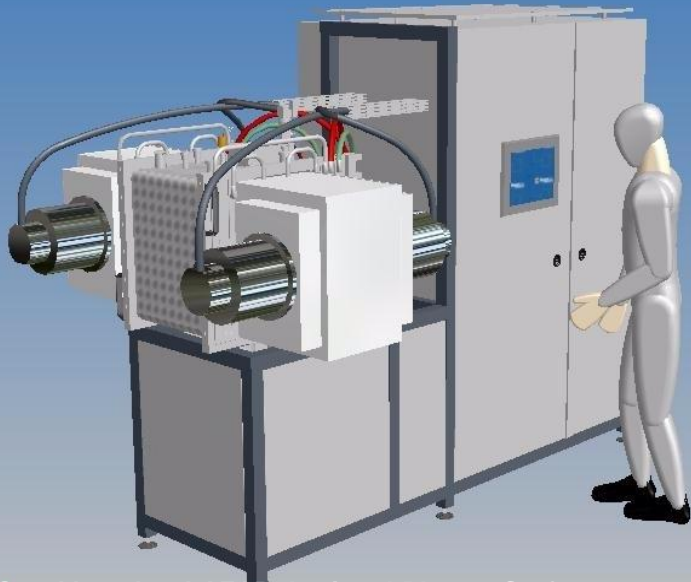
**Unidirectional dual Large Area Filtered Arc Deposition (LAFAD™) and Filtered Arc Assisted Magnetron Sputtering (FAAMS™) sources for retrofit or integration into conventional coating equipment:**

- Deposition areas ranging from 0.5m up to 2m
- \*Coating thickness uniformity and deposition rates deliver conformal hard coatings on complex 3D surfaces cost effectively:
  - Metal and ceramic coatings (nitrides, carbides, oxides, borides)
    - $>3\mu\text{m/hr}$  (for substrates installed on rotary table 0.5m dia with single rotation)
    - $\pm 10\%$  thickness uniformity for ceramic coatings deposited by LAFAD™ or FAAMS™ sources utilizing billet targets
  - Superhard hydrogen-free ta-C DLC coatings ( $H > 70\text{GPa}$ )
    - $>1\mu\text{m/hr}$  (for substrates installed on rotary table 0.5m dia with single rotation)
- Thickness uniformity is better than  $\pm 2\%$  for coatings deposited by LAFAD™ or FAAMS™ sources utilizing planar-rectangular or rotary-cylindrical targets
- LAFAD™ sources exceeds 4% metal ion output current yield making it more efficient than typical technologies seen in production today

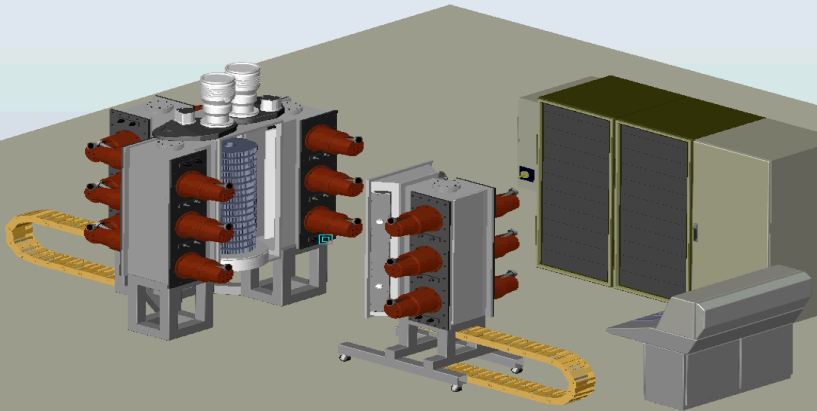
**\*Please visit our website for further details and contact us directly to learn more about how we achieve deposition rates and uniformity listed in this brochure.**

**Opportunities for collaboration and investment.**

# LAFAD™ SURFACE ENGINEERING SYSTEM



V. Gorokhovskiy, "LAFAD-Assisted Plasma Surface Engineering Processes for Wear and Corrosion Protection: A Review"



# FAAMS™ SURFACE ENGINEERING SYSTEM

US Pat. ## 7300559, 9761424, 9765635, 10304665, other patents pending

## LAFAD™ and FAAMS™ Technology Highlights:

Access our large portfolio of proven surface engineering processes:

- Metal ceramics
  - Nitrides, carbides, oxides, borides
- Superhard hydrogen-free ta-C DLC ( $H > 70 \text{ GPa}$ )
- Remote arc plasma immersion surface modification
  - ionitriding, reactive ion etching, low energy ion implantation

Technology built for industry:

- Super adhesion of thin films and coatings
- Deposit high-value super-lattice and nanocomposite films
  - multi- phase ultra-fine polycrystalline, and/or amorphous structures
  - Nanostructure size ceramic crystal growth at the nanometer level
- Duplex and triplex plasma immersion surface engineering processes in one vacuum cycle
- "Hybrid" processing and plasma enhancement of conventional PVD and CVD processes:
  - metal vapor plasma with high kinetic energy of metal ions
  - controllable metal ions concentration in the mixed ion/neutral atomic flows from 0 to 100%
  - atom-by-atom deposition of smooth nanostructured layers over a large area substrate
  - healing the initial substrate surface defects with energetic metal ion bombardment
  - patented, modular design approach is commercially scalable and cost effectively tailored for individual customer and specific application specs

**Contact NPE directly to learn more or for collaboration and investment.**