TiAlSiN and CrAlSiN nanocomposite protective coatings

Prelims: *Current events of National and International Importance| Science & Technology*

Why in News?

Scientists at the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI) in Hyderabad have developed advanced TiAlSiN and CrAlSiN nanocomposite protective coatings to dramatically enhance the durability of tungsten carbide cutting tools used on nickel-based superalloys.

Performance Gains

- **TiAlSiN Coating –** Boosts tool life by **80%** for Inconel 718 (IN718) and **60%** for Inconel 625 (IN625).
- **CrAlSiN Coating–** Increases tool life by **more than 200%** for Inconel 617 (IN617).
- **Targeted Failure Mitigation–** Addresses primary machining failure modes including abrasion, adhesion, attrition, and chipping.

Impact on Key Sectors

- **Aerospace–** Enables micron-level accuracy and higher surface integrity for aircraft engine components and turbine blades, reducing rejection rates and supporting local aviation manufacturing.
- **Energy–** Lowers capital and operational costs for machining tough components used in boilers, turbines, and heat exchangers across thermal, nuclear, and ultra-supercritical power plants.
- **Petrochemical–** Improves the economical fabrication of corrosion-resistant equipment like deep-sea drilling gear, refinery piping, and chemical reactors made from alloys like IN625.

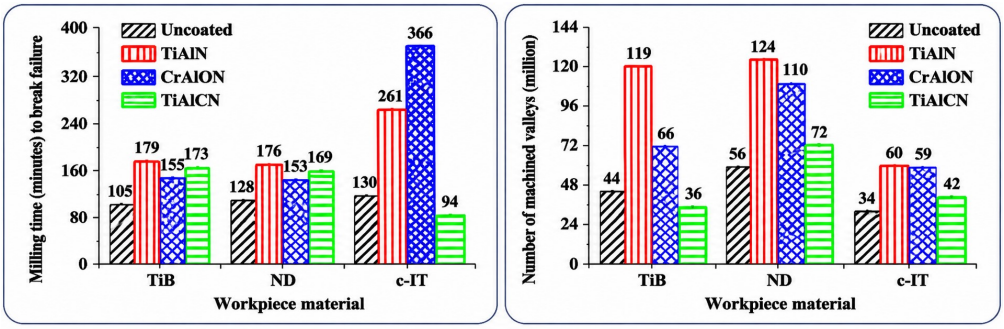


Fig 1: *Advanced nanocomposite coatings significantly improve the life of tungsten carbide cutting tools. The results show that the optimum coating depends on the specific nickel-based superalloy being machined.*

Reference

[PIB| TiAlSiN and CrAlSiN]

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