



# Comparative Ceramic & PVD CrN

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# Introduction to PVD CrN

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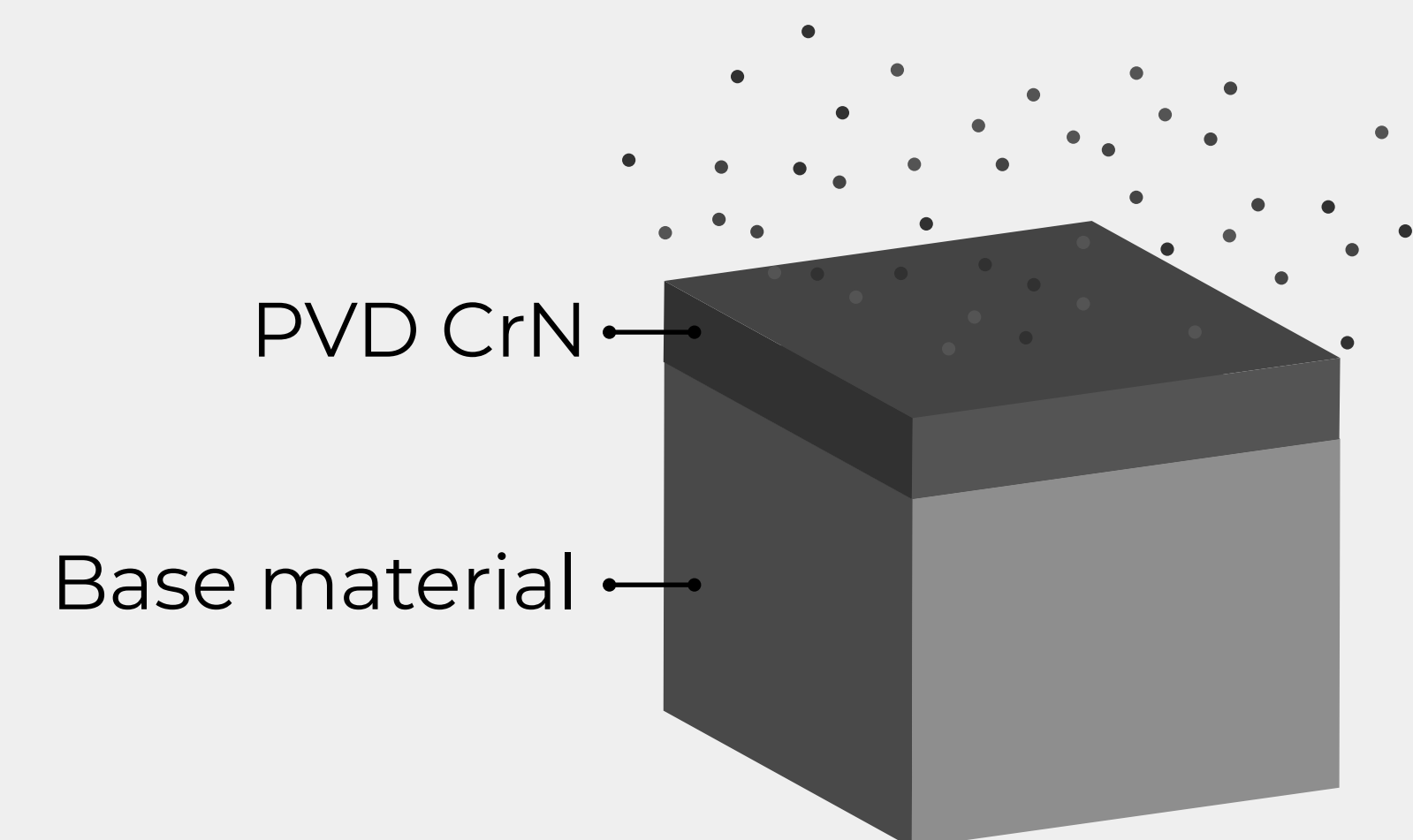
## a. What is PVD CrN?

Chromium Nitride is a chemical compound with the formula CrN. It is a very hard and corrosion resistant ceramic. It comes in the form of a magnetic powder insoluble in acids and bases.

## b. How is it applied?

PVD deposits are made using the Physical Vapour Deposition technique. The coating phase is carried out in a vacuum chamber after an initial relatively high vacuum has been achieved.

## c. Application schematic



# Materials Comparison

## a. Hardness comparison:

Crn	2000 - 2400 HV
Alumin	2300 HV
Y203 Zircon	1300 HV
Chrome	1000 - 1100 HV
MGO Zircon	1100 HV

Hardness improves **impact resistance**.

The hardness allows to reduce the CrN thickness (1-4µm).

This allows us to **reduce the gap** between cylinder and piston, therefore : **reduce the risk of leakage**.

## b. Thermal stability:

CrN coating **resist corrosion** that can be caused by **sterilization** and chemical **autoclaving**.

The coating will destabilise at temperatures above **600°C**.

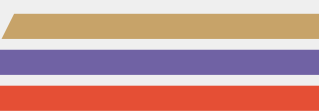
This can also allow compatibility with the **CIP/SIP** technology.



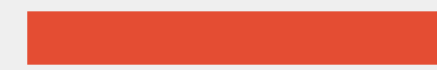
# Advantages of PVD CrN

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- Mechanical resistance:
  - improves **wear** and **impact resistance**.
  - Reduced thickness = reduce the gap = **reduce the risk of leakage**.
  - **Thermal stability** allowing CIP/SIP compatibility and autoclave and sterilization cycles.
  - **Lower price** than ceramics.
- **High Chemical Resistant.**
  - Compatibility with most products.
  - **Clean visual aspect.** No traces after use.
  - Possibility of **refurbishment** and **maintenance**
  - **FDA** approval.



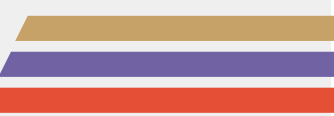
# Advantages of PVD CrN



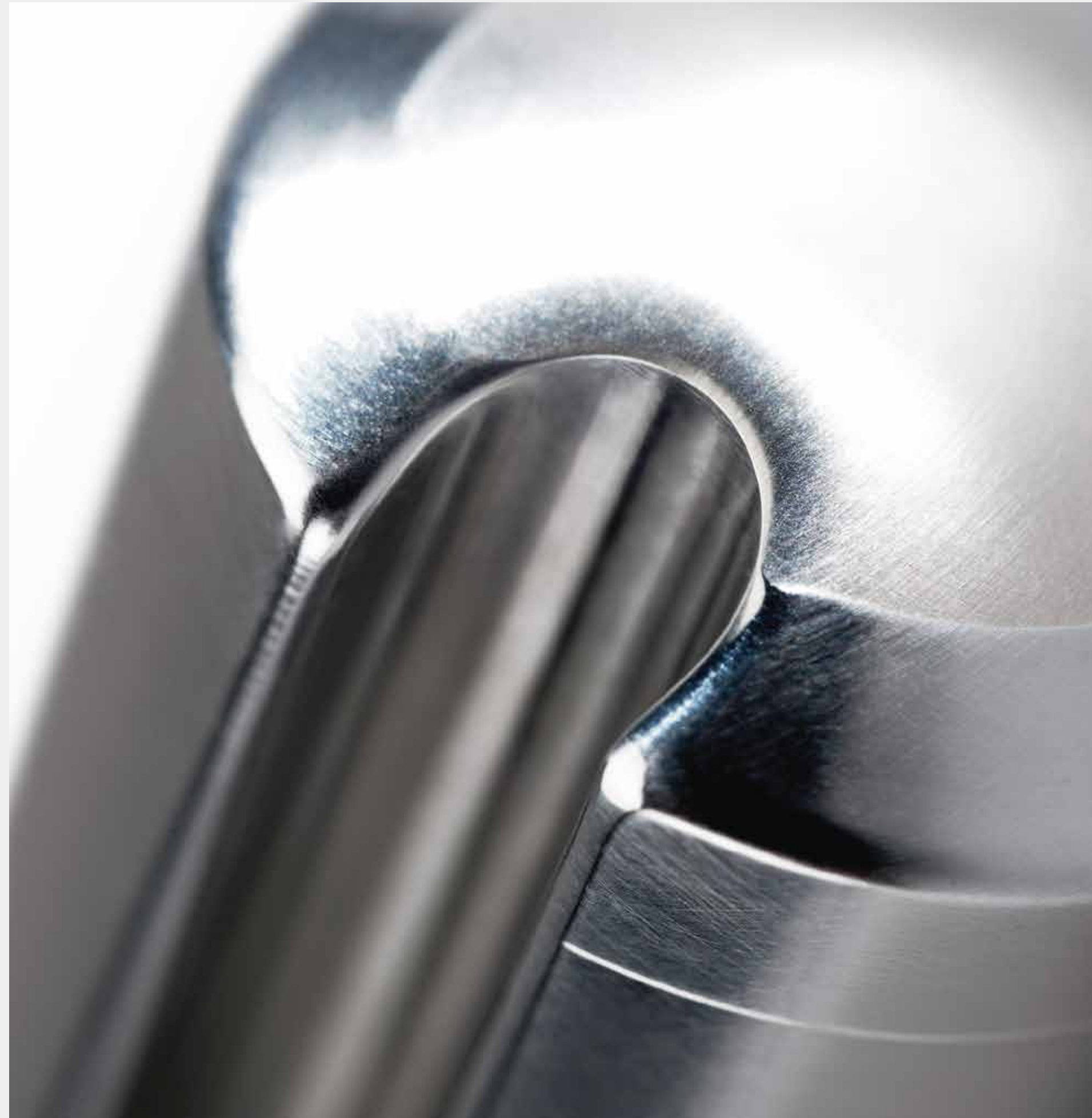
## b. FDA approval

### a. To resume :

	Cost	Sensitive to shocks	Fragility (risk of breaking)	Wear sensibility	CIP/SIP Compatibility	can be autoclaved	can be sterilized	Cost of repair (repair of piston only)	Potentiel dirty Area
316L + Alumin	High	Medium	High	Low	Yes	Yes	Yes	High	Yes
316L + Y203 Zircon	High	Medium	High	Medium	Not ideal (particules)	Not ideal (particules)	Not ideal (particules)	High	Yes
316L + MGO Zircon	High	Medium	High	Low	Yes	Yes	Yes	High	Yes
316L + Cr	Low	High	Medium	Medium	Yes	Yes	Yes	Low	No
316L + Cr + Crn	Medium	Low	Low	Low	Yes	Yes	Yes	Low	No



# Our application



## a. Our application schematic

