



Comparative Ceramic & PVD CrN

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Introduction to PVD CrN



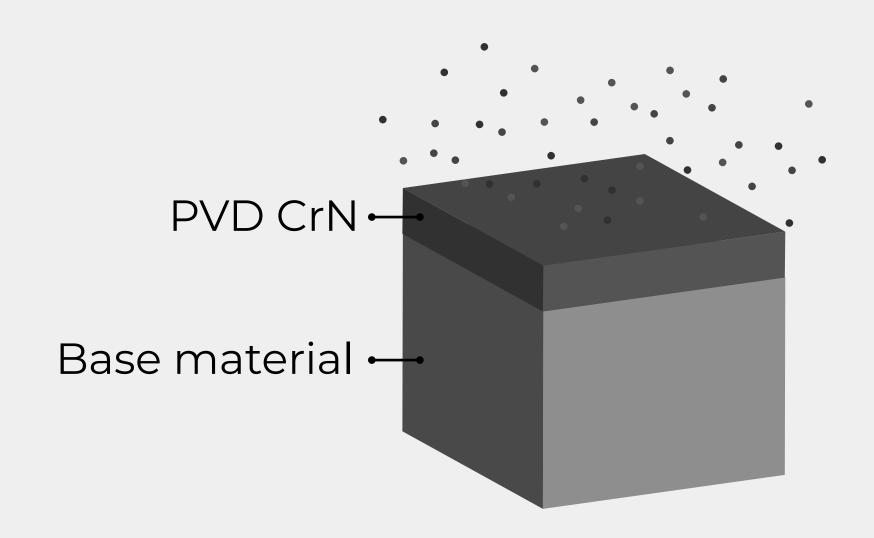
a. What is PVD CrN?

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



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

MANUFACTURING

a. To resume:

	Cost	Sensitive to shocks	Fragibility (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

b. FDA approval



Product Certification Services

The detailed composition of below mentioned coating material has been disclosed to RCC Product Certification Services by Balzers AG, Balzers / Fürstentum Liechtenstein with letter of August 11, 2003.

Based on this information we herewith can confirm that

BALINIT D, BALINIT CNI and BALINIT CROVEGA (Chromium Nitride)

is listed in FDA's "Inventory of Effective Premarket Notifications for Food Contact Substances" under FCN no. 300 and therefore may be used as ceramic surface coating with a maximum thickness of 10 micrometers in repeat-use food processing and food packaging equipment in the

United States of America

Please note: This certificate is limited to the formulation disclosed to RCC as mentioned above. Any change of the formulation will void the certificate automatically. Any changes in this formulation must be addressed to RCC immediately.



Itingen, August 26, 2003 Expiration date: August 26, 2006 RCC Project 850725 / BOP



P. Bodmer

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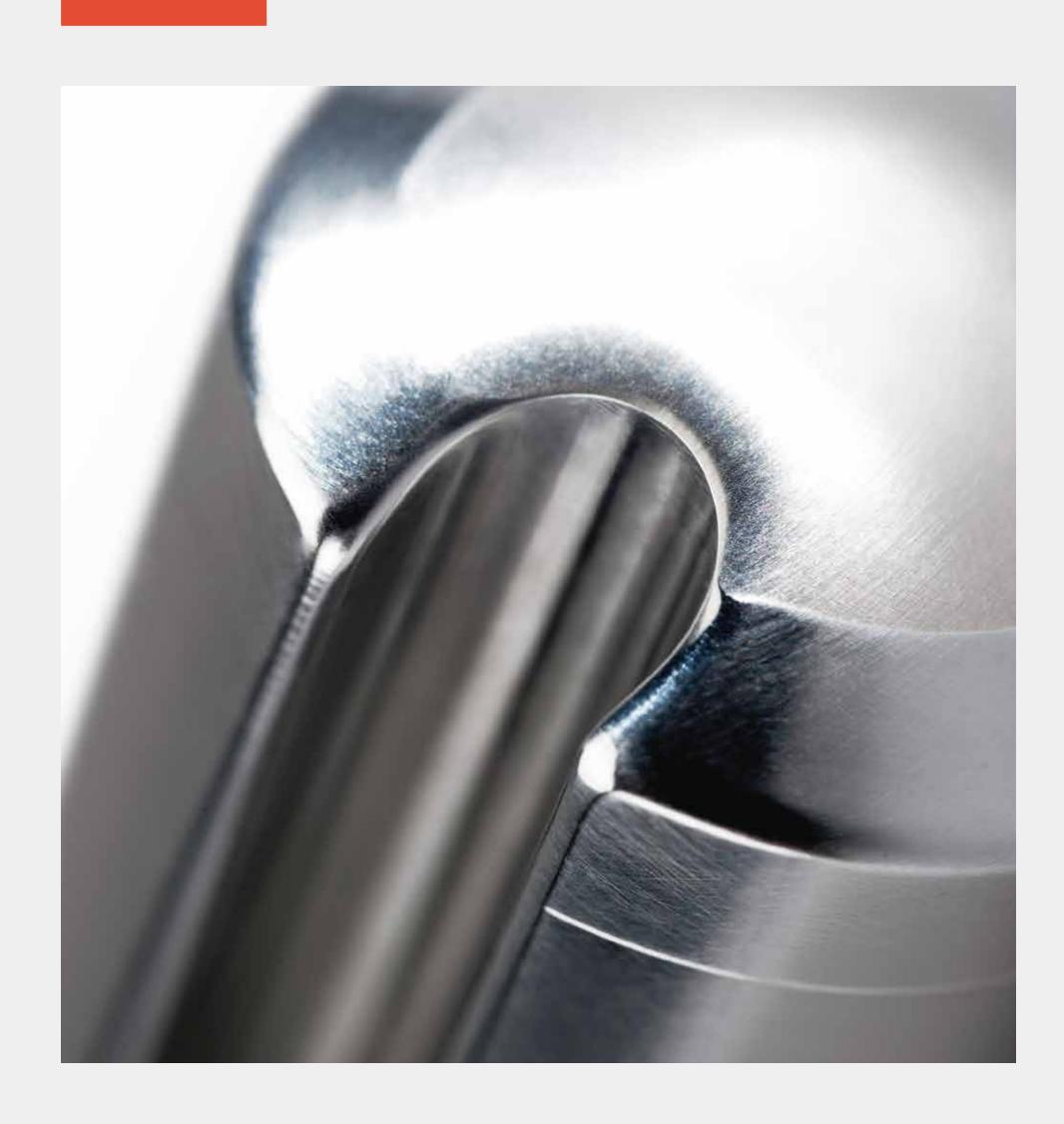
RCC PRODUCT CERTIFICATION SERVICES – accredited by the Competent Authorities according to EN 45011 as CERTIFICATION BODY operating product certification – an individual department of RCC Ltd.

Accredited services are defined in the official directory of accredited Certification Bodies SCES 019



Our application





a. Our application schematic

