

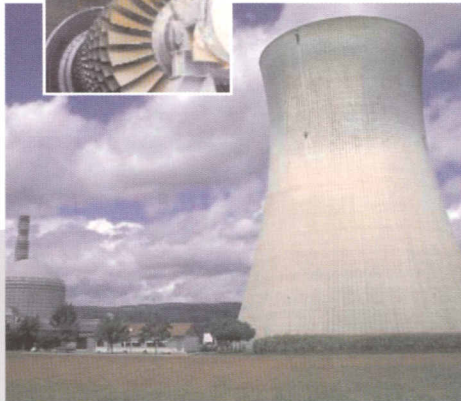


## High-performance belt grinding in turbine manufacturing and repairing

# Your Turbines



**Aircraft**

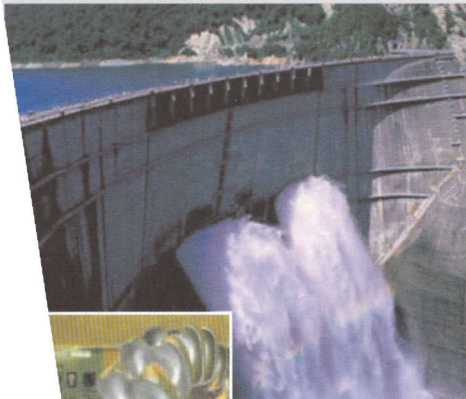


**Steam turbine**



**Power generation**

**Hydropower turbine**



**Marine engine**



**Marine propeller**

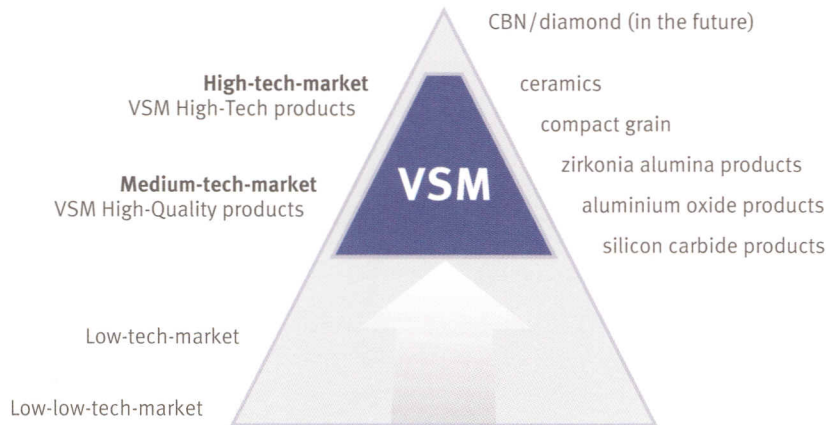




# VSM® – Your specialist for turbine grinding

**We offer quality products for greatest economic efficiency through:**

- high-performance products
- competence in application support and development of abrasives
- reliability in terms of quality and delivery



**VSM OFFERS HIGH TECH AND HIGH QUALITY PRODUCTS WHICH PROVIDE EXCELLENT PERFORMANCE AND EXCELLENT RESULTS FOR GRINDING TURBINE BLADES AND VANES.**

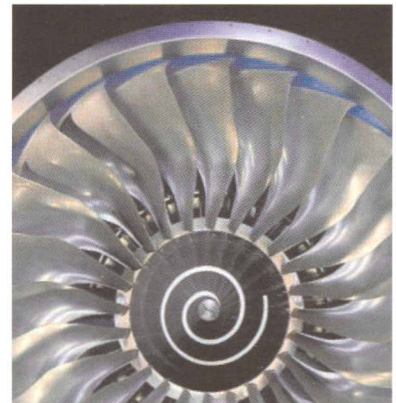
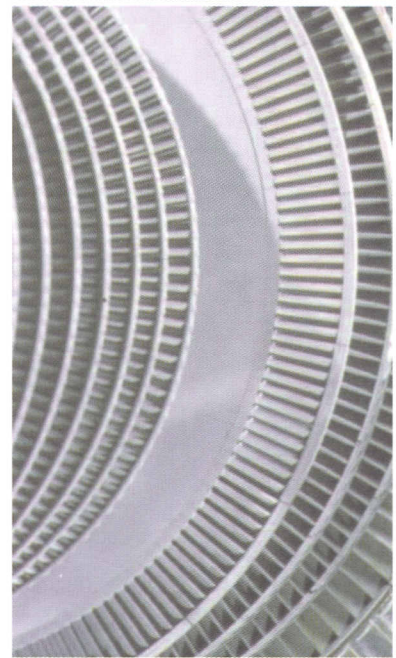
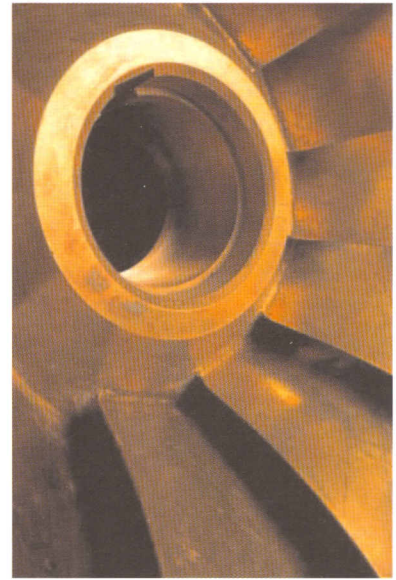
## Your benefit:

### Perfect surface quality

- electro-static coating technique
- optimal belt joint technology
- wide range of flexibilities from very flexible (F-backing) to very robust (Y-backing)

### Reliability

- innovative solutions for abrasives
- competent consulting on application techniques
- decades of experience in belt conversion



# Application example 1: Manufacturing of titanium

Workpiece: Fan blade  
Material: Ti6AL4V Alloy  
Features:  
— high toughness  
— good machinability and weldability  
— heat sensitivity

## Grinding conditions

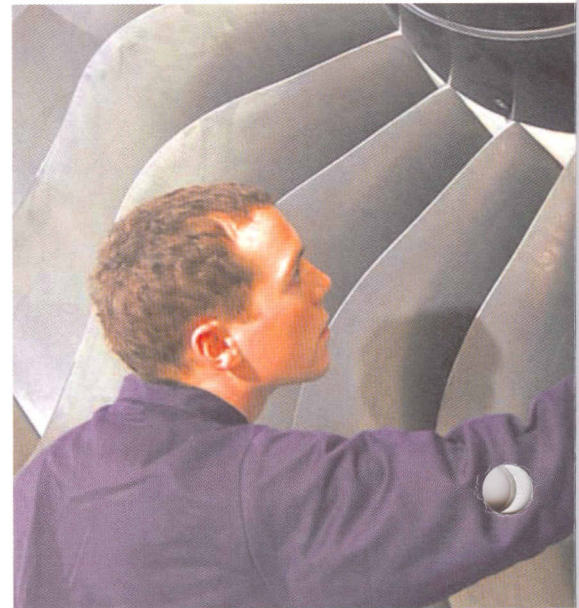
Grinding operation: Off-hand grinding and removal of airfoil surface defects, blending of forged and superplastic formed fan blades

Grinding machine: Backstand

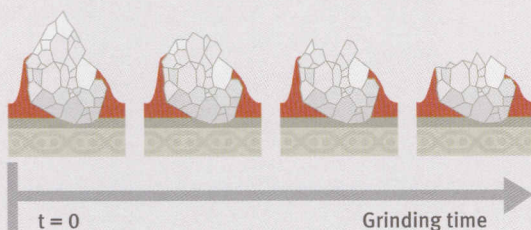
Contact wheel:  
— diameter: 350 mm  
— hardness: 70° Shore A  
— serration: 1:1 (land to groove ratio)

Cutting speed: 17 m/sec

Belt dimension: 50 x 3500 mm

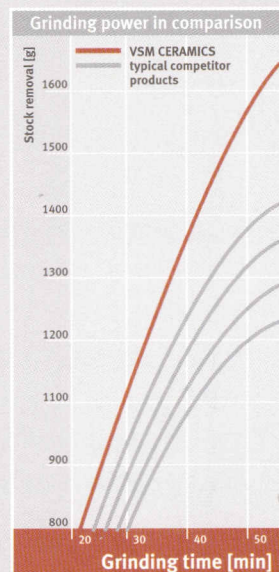


## ① VSM® CERAMICS products for roughing



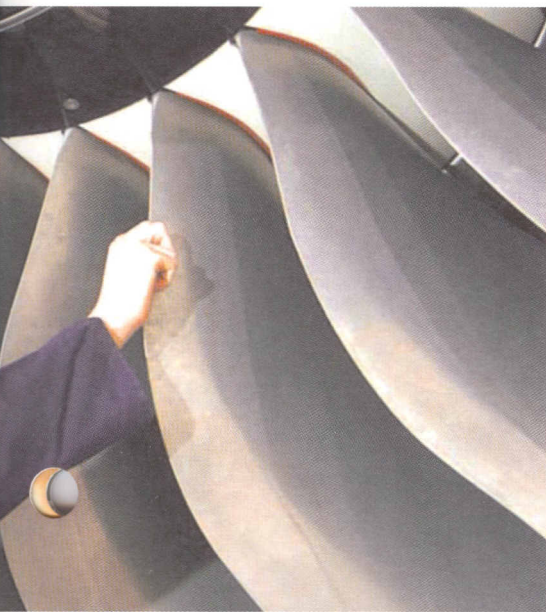
### Benefits of VSM CERAMICS

- high level of stock removal
- long service life
- continuous self-sharpening
- cool grinding
- for hard work pieces





# fan blades



## Workstep 1:

VSM product:

Grit range:

Characteristics:

Roughing (removal of defects)

VSM SK840X **CERAMICS** ①

# 24, 36, 40, 60, 80, 100, 120

- powerful cutting action due to the sturdy backing in combination with the continuous creation of new grain cutting edges
- very reliable belt joints for the usual tooling systems
- Top Size coating avoids overheating

## Workstep 2:

VSM product:

Grit range:

Characteristics:

Finishing

VSM CK742J **COMPACTGRAIN** ②

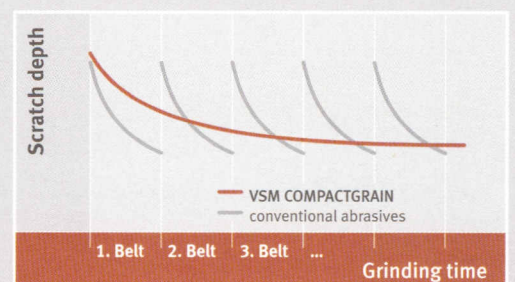
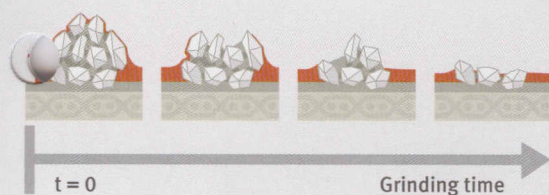
# 80, 120, 180, 320

- the highly flexible backing material ensures a close fit to the workpiece geometry
- the special coating technique reduces the heat development during the grinding process
- the optimal belt joint technology is leading to perfect surface qualities

## ② VSM® **COMPACTGRAIN** products for finishing

### Benefits of VSM **COMPACTGRAIN**

- even stock removal
- fine surfaces
- continuous self-sharpening
- consistent surface finish during its entire service life



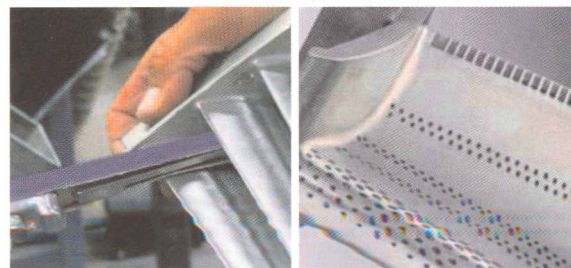


## Application example 2: Repairing of high pressure

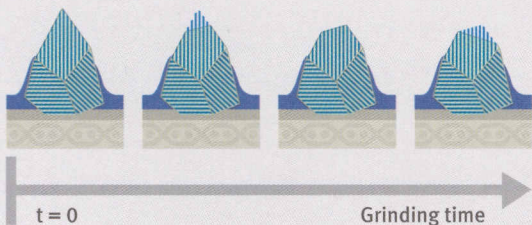
Workpiece:	HPT guide vane stage
Material:	Chrome-Nickel-Titanium alloyed steel
Features:	<ul style="list-style-type: none"><li>— resistant to high heat</li><li>— good deformability</li><li>— good weldability</li><li>— relative high toughness</li></ul>

### Grinding conditions

Grinding operation:	Off-hand grinding and rebuilding of the airfoil part after build up welding and soldering the HPT guide vane
Grinding machine:	portable power grinder with pneumatic drive
Contact wheel:	<ul style="list-style-type: none"><li>— diameter: 100 mm</li><li>— hardness: 60°–65° Shore A</li><li>— serration: 2:1 (land to groove ratio)</li></ul>
Cutting speed:	22 m/sec
Belt dimension:	20 x 760 mm

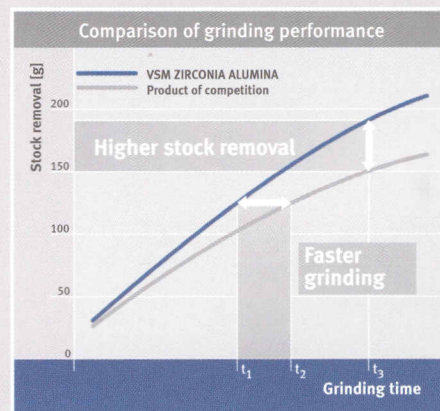


### ③ VSM® ZIRCONIA ALUMINA products for roughing



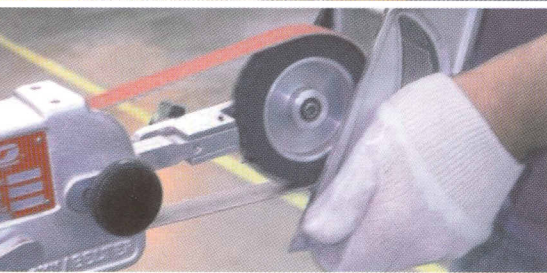
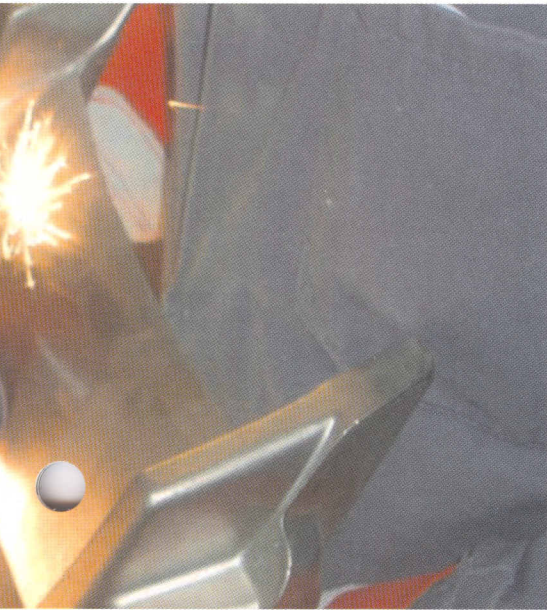
#### Benefits of VSM ZIRCONIA ALUMINA

- high level of stock removal
- long service life
- continuous self-sharpening





# turbine vanes



## Workstep 1:

VSM product:

Grit range:

Characteristics:

Roughing (high material removal)

VSM ZK744X **ZIRCONIA ALUMINA** ③

# 24, 36, 40, 60, 80

- powerful removal of hard welding seams and soldering skins
- excellent adhesion of the specially treated grain to the backing material
- optimal belt joints for typical tooling systems
- additional **TOP SIZE** ④ layer reduces the grinding temperature and increases the cutting rate

## Workstep 2:

VSM product:

Grit range:

Characteristics:

Finishing (improve surface smoothness)

VSM KK712J **COMPACTGRAIN** ②

# 80, 120, 180, 240, 320, 400

- medium bonded compactgrain for soft and smooth grinding
- the highly flexible backing material ensures a close fit to the workpiece geometry
- very long service life due to the high reserve of abrasives of the self-sharpening compactgrain

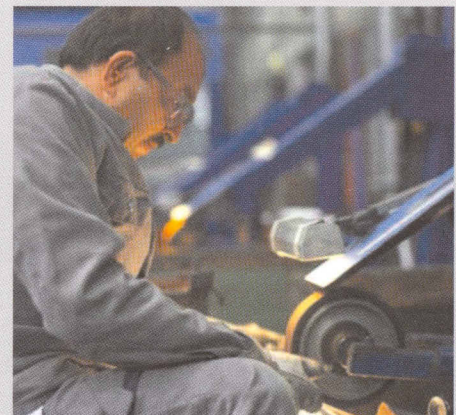
## ④ VSM® **TOP SIZE** products for cool cutting



### ADDITIONAL LAYER (TOP SIZE)

- for cooler grinding
- for higher cutting rate

ADDITIONAL COATING LAYER (TOP SIZE)





# VSM Products designed for turbines

Application	Manufacturing			Repairing			Grain Type	Backing	VSM Series	
Material	Removal of cast-lugs and riser	Removal of surface defects after casting or forging	Grinding and forming of the airfoils	Removal of notch, dents, cracks and scratches	Removal of seams and soldering surfaces	Removal of honeycomb seals and wearing parts				Grit
Titanium Alloys (Ti6AL4V, Ti 6242, Ti 6246, IMI 834 and others)										
cold	● (●)	● (●)		● (●)	● (●)	● (●)	24, 36–120	CER	Polyester	VSM SK750X
			⊙ (●)		⊙ (●)		80, 120, 180, 240, 320, 400, 600	COM-AO	Polyester	VSM KK712X
			⊙		⊙		80, 120, 180, 240, 320, 400	COM-AO	Cotton	VSM KK712J
			● (●)				80, 120, 180, 240, 320, 400	COM-SIC	Polyester	VSM CK748X
		○	○				80, 120, 180, 320	COM-SIC	Cotton	VSM CK742J
		○ (●)		○ (●)			24, 36–240, 320, 400, 600	SIC	Polyester	VSM CK721X
			○	○			60–320	SIC	Cotton	VSM CK721J
			○	○			60–400, 600	SIC	Cotton	VSM CK721F
	●	●		●	●	●	24, 36–120	CER	Fibre	VSM SF750
	⊙			⊙		16, 24, 36, 50–120	SIC	Fibre	VSM SF08	
hot	Nickel and Super-Alloys (IN 713, Rene 70, 80, 95, IN 100, PWA 1484 CMS X 10 and others)									
	●	●		●	●	●	24, 36–120	CER ▼Top Size	Polyester	VSM SK840X
		●	●	●	●		50–120	CER ▼Top Size	Polyester	VSM SK840J
			●	●			80–180	CER ▼Top Size	Cotton	VSM SK840F
	●		●		●	●	24, 36–80	ZA	Polyester	VSM SK715X
	●	●		●	●		24, 36–80	ZA ▼Top Size	Polyester	VSM ZK744X
			⊙ (●)		⊙ (●)		80, 120, 180, 240, 320, 400, 600	COM-AO	Polyester	VSM KK712X
			⊙		⊙		80, 120, 180, 240, 320, 400	COM-AO	Cotton	VSM KK712J
	⊙ (●)	⊙ (●)		⊙ (●)	⊙ (●)		36–180	AO	Polyester	VSM KK812X
	●	●		●	●	●	24, 36–120	CER ▼Top Size	Fibre	VSM SF840
	●	●		●	●	24, 36–80	ZA ▼Top Size	Fibre	VSM ZF844	

**Recommended Cutting Speed:**  
 Titanium Alloys = 7-17 m/s  
 Super-Alloys = 18-25 m/s  
 Brass and Bronze = 32-38 m/s

○ for low to medium contact pressure  
 ○ for medium contact pressure  
 ● for medium to high contact pressure  
 (●) suitable for wet applications

E extremely flexible  
 F very flexible  
 J flexible  
 K Velcro backing  
 T robustly flexible  
 X robust  
 Y very robust

COM-AO Compactgrain: Aluminium oxide  
 COM-SIC Compactgrain: Silicon carbide  
 ▼ Top Size Additional grinding layer for cooler grinding and higher cutting rate  
 CER Ceramic  
 ZA Zirconia Alumina  
 AO Aluminium Oxide  
 SIC Silicon Carbide