

Innovation at Oerlikon – a Key Success Factor

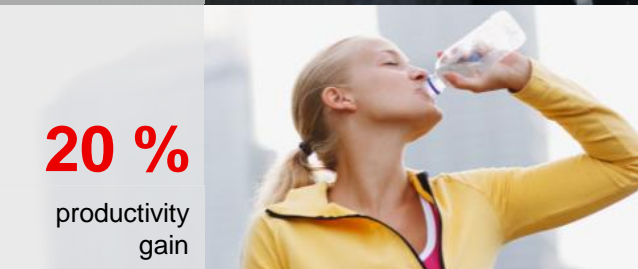
Lucerne, April 10, 2018

Dr. Helmut Rudigier – CTO Oerlikon Group

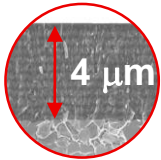
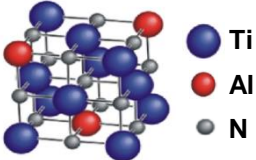
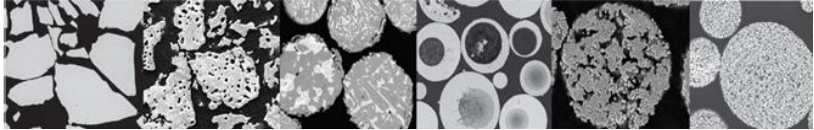








Our Technologies Advance Megatrends

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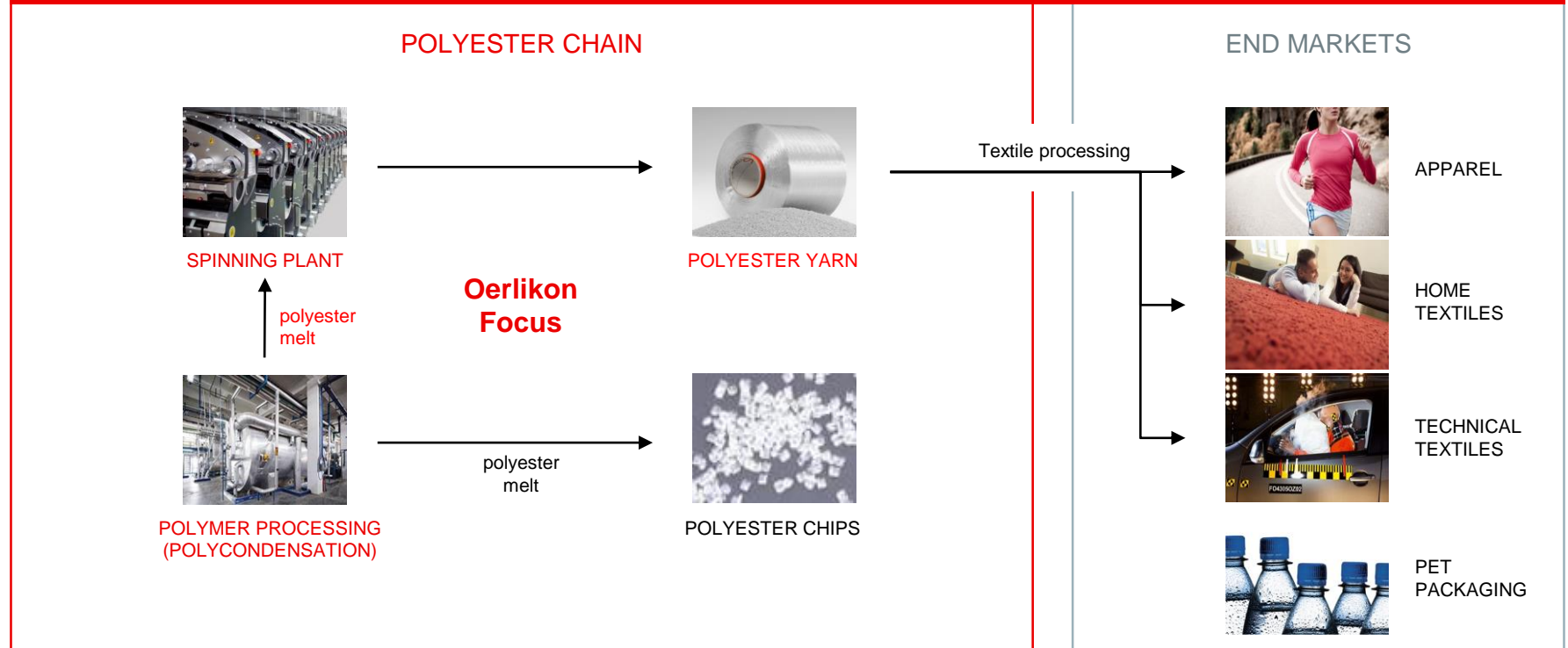


We Are a Global Leader in Advanced Materials and Surface Solutions

Balzers Industrial Solutions	Metco Aero and Energy
<p>Coating materials</p>   <ul style="list-style-type: none">TiAlN	
<p>Technology development</p> 	<p>Technology development</p> 
<p>Applications expertise</p>    	

We Are a Global Leader in Materials Processing in Manmade Fibers

From melt to yarn, fibers and nonwovens



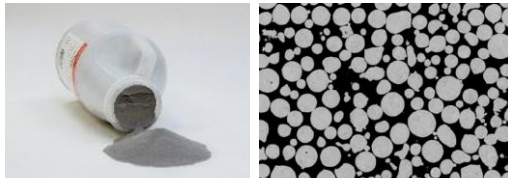
The Logical Next Step: Additive Manufacturing – Expanding from the Surface into the Structure

COATING TECHNOLOGY

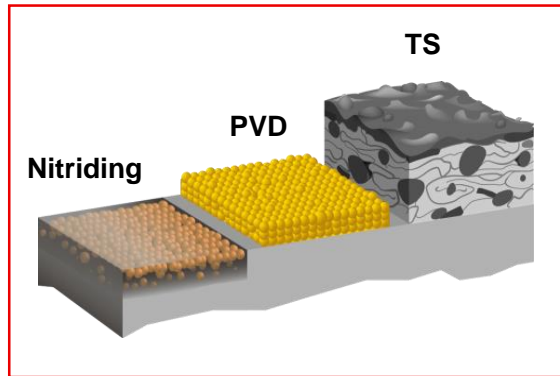


- Equipment, integrated systems and spare parts (thermal spray and PVD)
- Coating service

MATERIALS TECHNOLOGY



- Metal and ceramic powders for thermal spray
- Braze and weld overlay materials
- Matrix materials and suspensions
- Metals for powder-bed additive manufacturing



ADDITIVE MANUFACTURING OF COMPONENTS



Global Leading Technology Portfolio – Pushing the Boundaries with Organic R&D Efforts

R&D key figures

R&D expenses/
sales



4 %

Active
patents



>5 000

Revenues generated
by new products
(Vitality Index)



20 %

Customer-specific
R&D expenses



25 %

Patents filed
in 2017



90

Global Leading Technology Portfolio – Strategic Portfolio Expansion Through Acquisitions

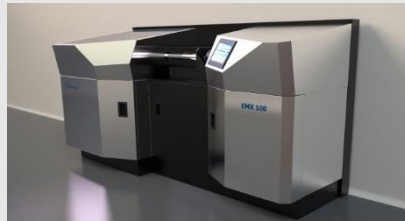
Scoperta



Data science applied across Oerlikon:

- New materials
- Improved material properties
- Faster development cycles

Primateria



- Surface-finishing technology (pre- and post-treatment)
- Reduced time to market
- Service business: tooling and automotive

Diarc



- Sensor applications demonstrated for predictive maintenance and advanced control (Industry 4.0)
- Self-reporting coatings
- Solution for high-precision automotive and precision component applications

Global Leading Technology Portfolio – Extensive Network of R&D Collaborations and Partnerships

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Over 50 R&D collaborations

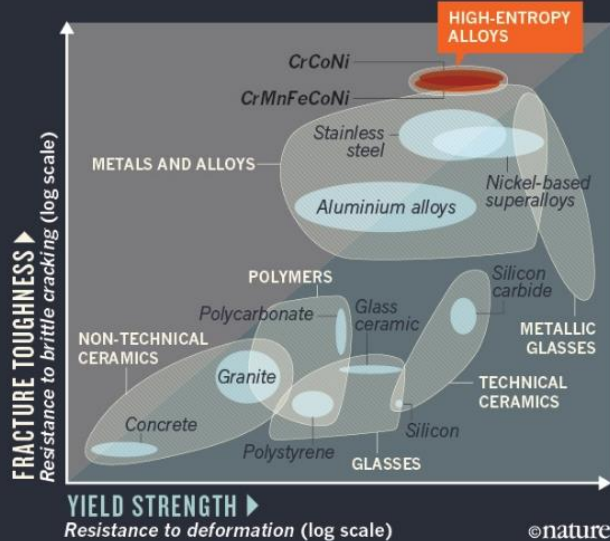


What is Next? New Class of Materials: Research across Business Units – Complemented by Network Collaborations

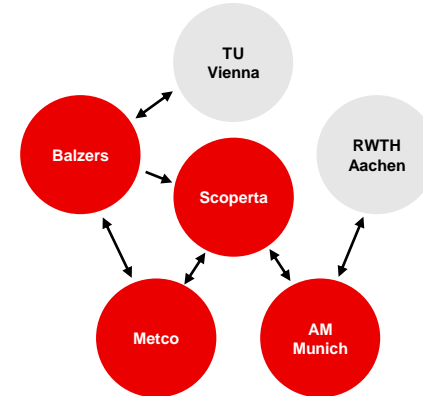
High-entropy alloys – a new class of materials

TOUGH AND STRONG

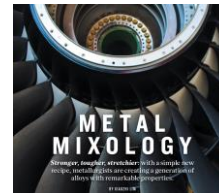
By mixing multiple metals in roughly equal proportions, high-entropy alloys can offer unique combinations of yield strength and fracture toughness.



Internal and external competencies combined



Opportunities



“Hotter running jet engine blades” (AM) (Nature, May 2016)

“New material class for cutting tools?” (Coatings, 2015)

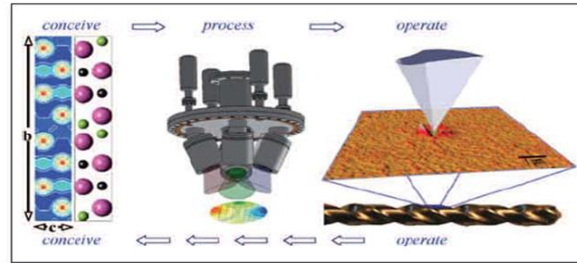
What is Next? Recognized for Material Science Expertise

Highlights from europeans journals

europysicsnews

APPLIED PHYSICS

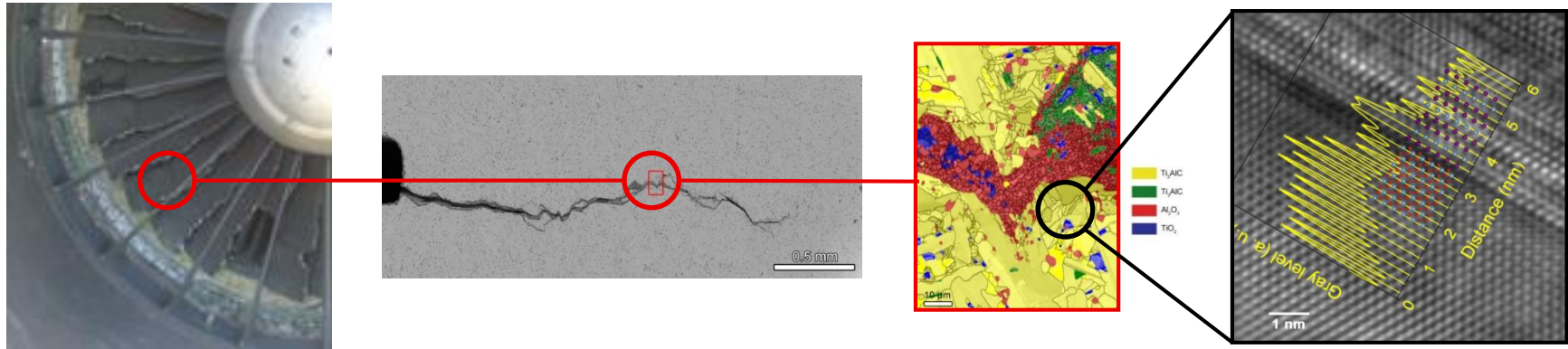
Quantum mechanically guided materials design (QMGM)



▲ QMGM. (Left) Unit cell and charge density plot of Mo₂BC showing covalent (high electron density) and metallic (low electron density) bonding contributions. (Middle) Schematics of combinatorial magnetron sputtering with image showing chemical composition gradient. (Right) Topographical image of a residual indent in Mo₂BC. Significant pile-up (20-50nm in height) around the indent and no visible cracks, suggesting moderate ductility.

What is Next? Game-Changing Material Properties

Oerlikon self-healing materials



**Leading engineering and process capabilities
and a fascinating materials and technology portfolio**

Cutting-edge R&D

- Advancing internal R&D
- Portfolio expansions through targeted acquisitions
- Strong innovation partnerships

Leverage portfolio across the Oerlikon Businesses



Innovation:
Oerlikon's key driver for profitable growth

Thank you.

