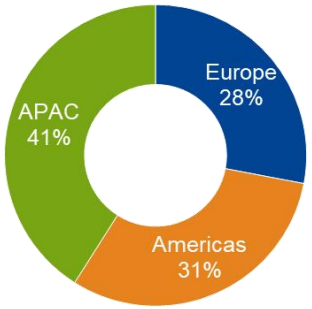
Höganäs

Powders for Additive Manufacturing (AM)

Meeting of ETN at Total, Pau, France 03-28-2019

Key facts Höganäs

- Annual production: 500,000 tons
- 2,500 co-workers in 18 countries
- Turnover: 8,2 MSEK in 2017
- Owned by FAM and Lindéngruppen
- Customers in 75 countries
- 950 granted patents



Side topic 1/2 (non-AM): We know the turbine markets

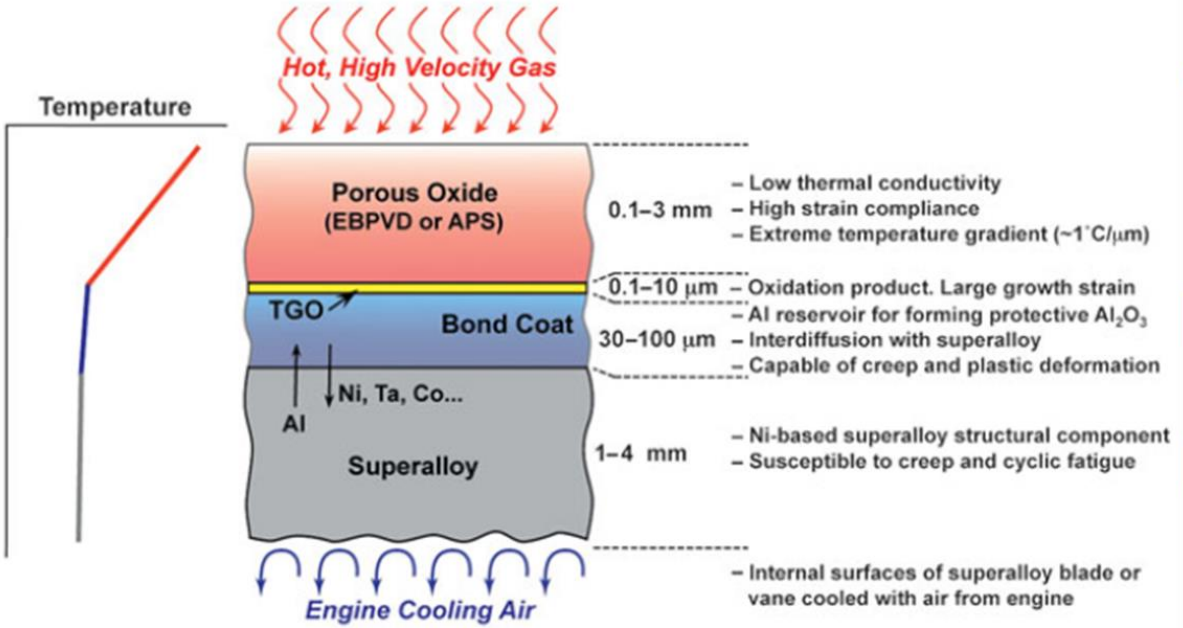
TBC coatings for IGT & aviation

Applications	Typical Materials	AMPERIT®
» Turbine Shafts	» ZrO_2-Y_2O_3	827, 831
» Support bearings	» Abradables	205
» Shroud Segments	» MCrAlYs	4XY
» Seal rings	» CrC-NiCr / WC-Co	51X, 52X, 53X, 58X
» Thermal barriers	» NiAl / NiCrAl	28X

Side topic 2/2 (non-AM): We know the turbine markets

We produce and develop TBC coatings for IGT & aviation

Thermal Barrier Coatings (TBCs) – are refractory-oxide ceramic coatings applied to the surfaces of metallic parts in the hottest part of gas-turbine engines. Efficiency and core power of gas turbine are directly related to the gas temperature entering the turbine section (resulting in increase of electricity output and for jet engines, the increase of thrust-to-weight ratio and durability). TBCs must have both thermal conductivity and low weight, they must be resistant to thermal shocks, and be chemically compatible with superalloy and TGO*.



We do

YSZ

MCrAlYs

Superalloys

AMPERPRINT® for Additive Manufacturing

Our standard AMPERPRINT® alloys [typically on stock; mainly 45/15µm for Laser powder bed AM]		
Fe-alloys	**Ni-alloys (superalloys for IGT/aviation)**	**Co-alloys**
AMPERPRINT® 0717 316L	AMPERPRINT® 0153 Ni-SA 625	AMPERPRINT® 0037 CoCrMo
AMPERPRINT® 0711 17-4 PH	AMPERPRINT® 0211 Ni-SA 230	
AMPERPRINT® 0742 15-5 PH	AMPERPRINT® 0181 Ni-SA 718	
AMPERPRINT® 1556 FeNiCoMo Maraging(18Ni300)	AMPERPRINT® 0151 Ni-SA 738 LC	
AMPERPRINT® 0638 FeCrMoSiVCMn H11 (1.2343)	AMPERPRINT® 0228 NiCrFeMo (HX)	
AMPERPRINT® 0634 FeCrMoSiVCMn H13 (1.2344)	AMPERPRINT® 0233 Haynes® 282®	
	AMPERPRINT® 0221 Ni-SA 247 LC	
	AMPERPRINT® 0152 Ni-SA 939	
Other standard alloys and customized product solutions are available upon request.		

IGT / Aviation
Many solutions here are tailored and confidential

Additive Manufacturing at Höganäs

DIGITAL METAL®

Machines

Components

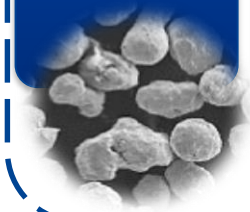
Höganäs

AM Powder Offering

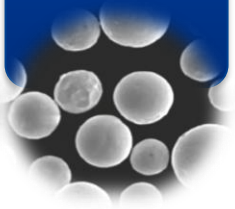
Broadest range of Products and Technologies in the market.

From highly customized, small batches to consistent, standardized products

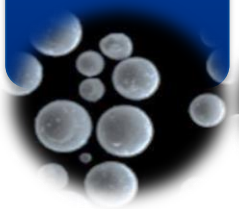
Water Atomized Fine Powders



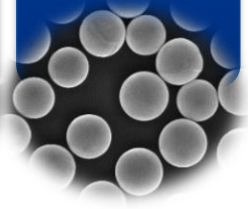
Gas Atomized Powders



Vacuum Melt Gas Atomized Powders



Plasma Atomization*



Fe base

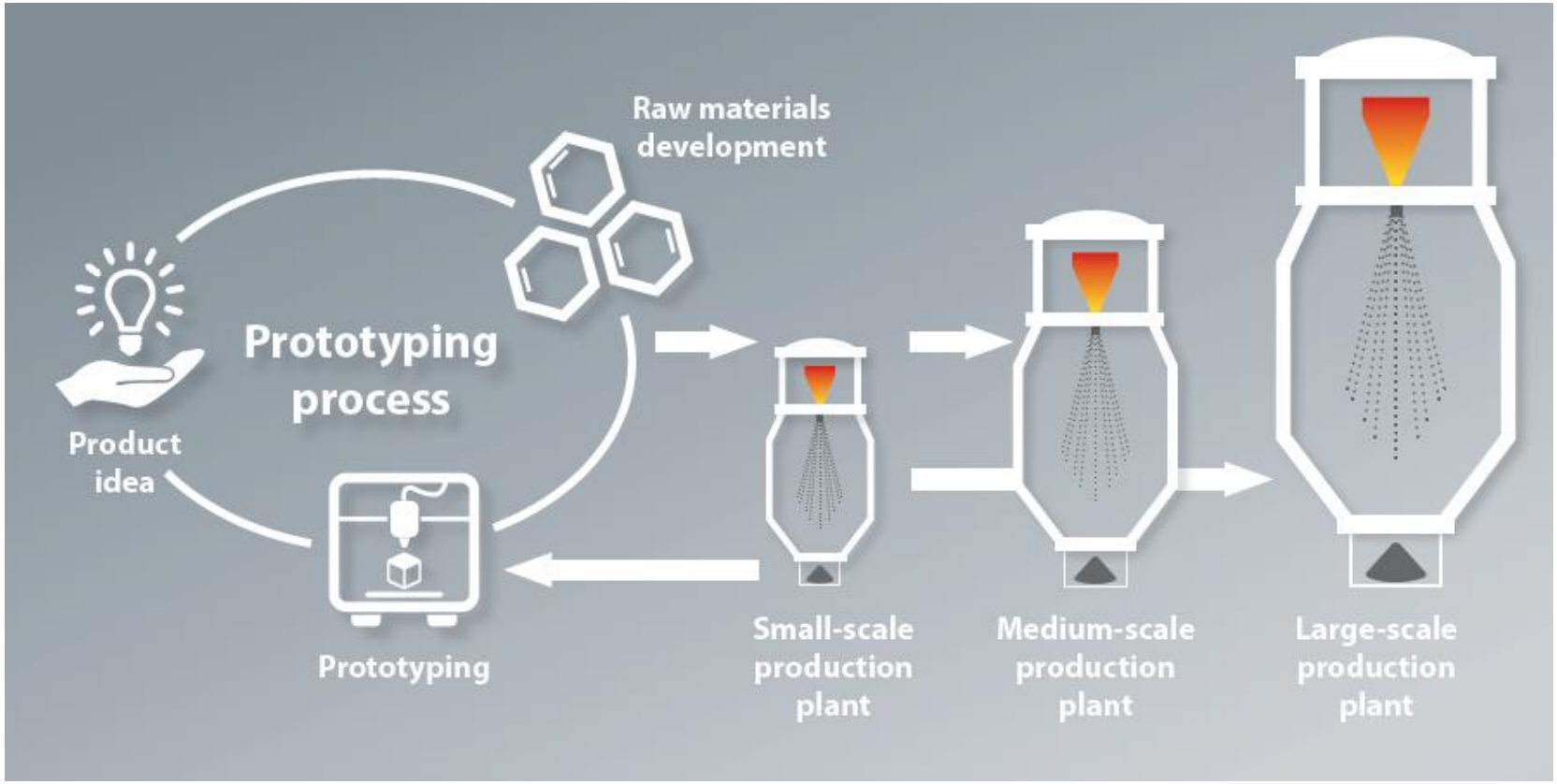
Turbines (Aviation/IGT

Impurity levels / e.g. O contents

Tailored powder solutions for IGT/Aviation

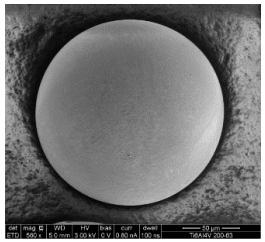
Vacuum Melt Gas Atomized Powders

Moving product innovations directly from lab to industrial scale

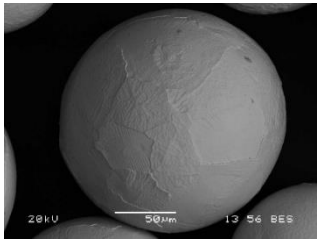


Plasma powder process: Metasphere Technology

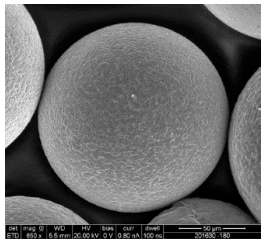
- Production in Luleå, Sweden
- High density, perfectly spherical particles without satellites
- Materials include metals, alloys, carbides, borides, intermetallics, and more
- Currently offering trial materials in selected projects



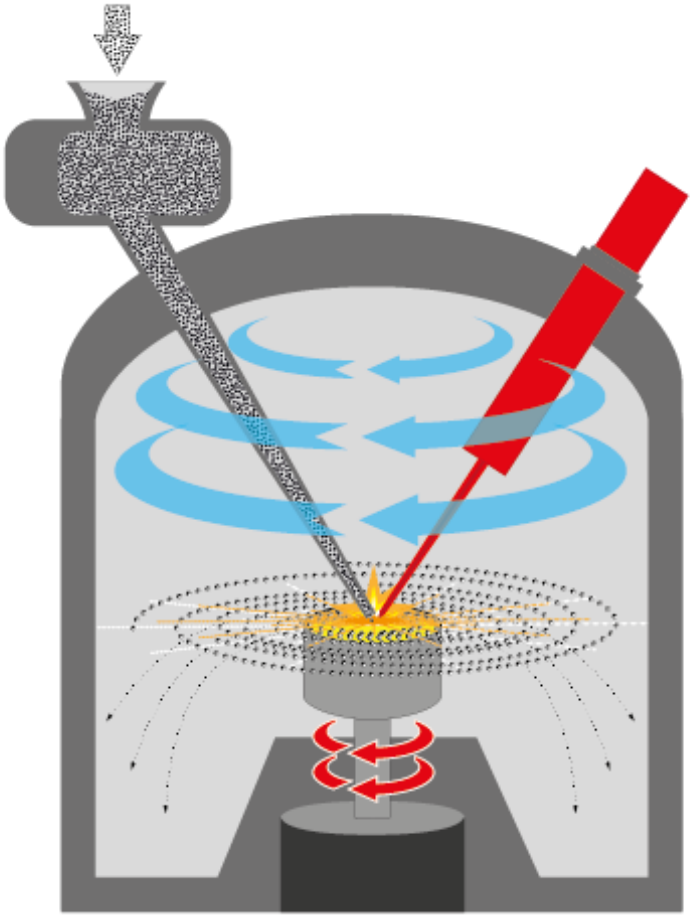
TiAl6V4



CTC



Co Cr



Summary

- Dynamics in powder demanding industries push new powder solutions (technologies and alloys)
- Ni superalloys can widely be adjusted (by powder metallurgical means) to optimize turbine (parts) efficiencies
- For new high temperature alloys please talk to us
- In this specific IGT & Aviation application field we can advance together. As a leading powder producer we are open to cooperate.
- Key success is the ability to innovate and develop unique powder solutions (understand wider conceptions)

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Thank you!