Prima Additive

Additive is competitive

Materials & Applications Handbook for **Direct Energy Deposition**

Contents

Next level.
Next to you.

The rapidly evolving field of Additive Manufacturing has still only touched the tip of the iceberg in terms of maturity, with significant progress still to be made in all areas, not limited to development of design, software, processes, materials, equipment and services.
In line with the Prima Industrie philosophy, Prima Additive is next to you as your partner offering a unique, full turnkey solution through this journey. Supporting you in all areas of additive powder bed fusion and direct energy deposition from design and application support through to provision of equipment with our long established global service network.
Our team of experts will always be available to listen, collaborate, assist and advise you.

What can be found in this brochure

A comprehensive selection of **Prima Additive Materials for Direct Energy Deposition Technology** for building, repairing, functionalizing and recoating metal components.

A straight path to the heart of Prima Additive, presenting **applications and manufacturing capacity.**

An **introduction** to our philosophy to discover our way of proceeding, planning and developing functional components.

A specialised and experienced **customer service,** ranging from application support to the design phase, as well as training courses and assistance throughout the national territory and beyond.

Straight to the heart of Prima Additive

With Prima Additive you make your business future-ready in few steps. Always next to the customer, our engineers will guide you through a concrete approach to improve your production process.

We provide a **support service dedicated to the customer** at every stage of system supply: from choosing the machines, based on the industrial sector, up to reaching the maximum manufacturing capacity.

Application support
Helping you identify how to rapidly deploy the Additive Manufacturing process to your business in the most competitive way possible

Design support
Supporting you in design for additive, we can design and build your prototype in our application centre

Field service
Both preventive maintenance and high-quality corrective maintenance to guarantee fast recovery when there is a problem. With more than 13,000 machines installed in more than 80 countries, we are able to give you the required assistance in your language

Remote care
Remote diagnostic and assistance. Skilled service engineers are available to operate remotely with your machines in real time

Training
Training programs and updates for using our machines and software to their best, maximising manufacturing capacity and quality

Wide range of training and consultation services

Our group of specialized engineers is always next to you. You have a unique opportunity to see first hand the capabilities of the technology and we can together identify how to rapidly deploy it in your business in the most competitive manner.

By choosing Prima Additive you take one more step towards the new frontier of manufacturing. We can offer training programs and updates for using our machines and software to their best, maximising manufacturing capacity and quality.

1

Pre-sales

- Demo activities in our Application Center
- Overview of the additive process through a real typical layout
- Application study of customer real case with possibility to prototype a real parts

2

Installation and operation

OPERATOR TRAINING

- Basic training on main functions of machine (control software operation, set up, safety)
- Training on peripheral equipment (dry oven, sieve etc)
- Practice on pre-selected parts to check main issues, alarms and operation details

APPLICATION TRAINING

- Use of Dedicated CAM software
- How to prepare a job file and generate the relative G-Code file
- How to support
- Rules of thumb for orientation and design for printing according to the used material

3

After-sales

- Application support
- Consultation
- Worldwide Service

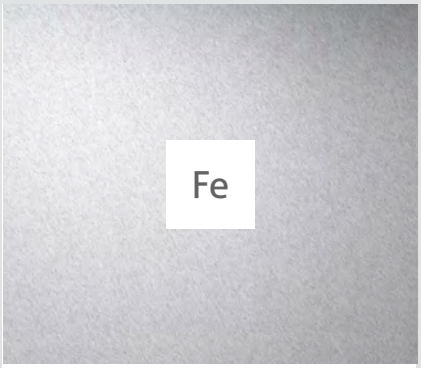
ADVANCED TRAINING

- Process parameters adjustment and process optimization
- Powder and part characterization

The variety of Prima Additive materials for DED Technology

Discover the list of materials available for your selective metal additive manufacturing. **Prima Additive offers a comprehensive selection of metal powders** ranging from aluminum through to nickel, steel, titanium as well as copper chrome alloys. In this way materials, machines and manufacturing parameters are harmonized for excellent results.

Prima Additive are constantly striving to improve materials technology, machines and processes to support you to qualify your powder. We develop the correct process parameters and set an optimal configuration for your machine to ensure quality and repeatability.

	Steel Alloys	Nickel Alloys
		
TYPE	316L, 340L, Maraging M300, 17-4PH, H13, FeCrV	In625, In718, Hastelloy X
DESCRIPTION	Excellent strength under elevated temperature combined with high corrosion resistance, hardness as well as high ductility, high post process finishing and good thermal properties	High yield, fatigue and creep strength with excellent anti-oxidation and anti-corrosion behavior in aggressive environments, high corrosion resistance at high temperatures high strength and good ductility
APPLICATION SECTORS	Oil and Gas Food Industries Aerospace Automotive Biomedical Chemical Mechanical components	Aerospace Automotive Biomedical Chemical Energy Oil and Gas Mechanical component Marine

Do you need to realize parts in a different material?

We are open to investigate and produce new materials suitable for additive in order to accommodate your specific needs. We will evaluate your business case, developing with you the best material for your application.

Titanium Alloys

Ti-6Al-4V*

Low specific weight combined with low thermal conductivity and expansion, excellent mechanical properties, high biocompatibility and high corrosion resistance

Aerospace
Automotive
Biomedical

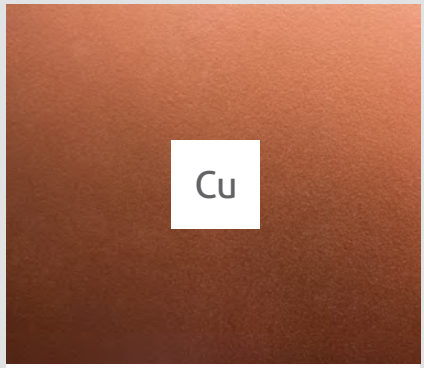
Cobalt-chromium Alloys

Stellite™ 6, Stellite™ 21

Biocompatibility, exceptional strength and durability, and resistance to wear and corrosion

Biomedical
Energy
Oil and Gas
Automotive
Design objects
Jewelry

Copper Alloys



CuSn10, Gr-Cop84, Cu-Mn

High resistance against corrosion combined with mechanical properties and both thermal and electrical conductivity

Electronics
Aerospace
Jewelry

** Processable only with inert chamber option*

Steel Alloys

AISI316L

MATERIAL PROPERTIES	APPLICATIONS
High corrosion resistance	Oil and Gas
High hardness	Food industries
High ductility	Automotive
High post process finishing	Aerospace
High strength under elevated temperature	Moulds
	Surgical tools

Chemical Composition (wt-%)

Fe	Cr	Ni	Mo	Mn	Si	P	S	C	N	O
Balance	16-18	10-14	2-3	2	0.5-1	0.045	0.005	0.03	0.1	0.1

MECHANICAL DATA	UNIT	AS-BUILT
Particles Size Distribution	µm (inch)	45-180 (0.0017-0.007)
Density	g/cm^3	7.9
Part Accuracy	mm (inch)	0.2 (0.0078)
Thinnest single track	mm (inch)	2-2.5 (0.078-0.098)
Layer thickness	mm (inch)	0.5 (0.02)
Roughness	R_a (µm)	As-built: >15
Tensile strength	R^m (MPa)	630±8
Yield strength	$R^{p0,2}$ (MPa)	475±2
Young modulus	E (GPa)	202±3
Elongation at break	A (%)	30±0.6
Hardness	HRC	22±2

H13

MATERIAL PROPERTIES
High stength
High hardness
High fatigue strength
High post process finishing

APPLICATIONS
Moulds
High Structural Strenght Components
Tools

Chemical Composition (wt-%)

Fe	Cr	Ni	Mo	Mn	Si	P	S	C	N	O	Cu	V
Balance	5	<0.1	1.4	0.44	1.09	≤ 0.01	≤ 0.01	0.42	≤ 0.1	≤ 0.1	0.01	0.94

MECHANICAL DATA	UNIT	AS-BUILT
Particles Size Distribution	µm (inch)	45-180 (0.0017-0.007)
Density	g/cm^3	7.8
Part Accuracy	mm (inch)	0.2 (0.0078)
Thinnest single track	mm (inch)	2-2.5 (0.078-0.098)
Layer thickness	mm (inch)	0.5 (0.02)
Roughness	R_a (µm)	As-built: >25
Tensile strength	R^m (MPa)	1925±30
Yield strength	$R^{p0,2}$ (MPa)	1410±50
Young modulus	E (GPa)	N/A
Elongation at break	A (%)	5±1
Hardness	HRC	60±1

Steel Alloys

17-4PH

MATERIAL PROPERTIES	APPLICATIONS
Precipitation-hardening steel	Chemical
High tensile strenght	Medical
Moderate corrosion resistance	Aerospace

Chemical Composition (wt-%)

Fe	C	Si	Mn	Cr	P	S	Ni	Mo	Cu	Nb	N
Balance	0.05	0.61	0.27	15.25	0.014	0.004	3.02	0.04	3.13	0.26	0.09

MECHANICAL DATA	UNIT	AS-BUILT
Particles Size Distribution	µm (inch)	53-180 (0.002-0.0072)
Density	g/cm^3	4.45
Part Accuracy	mm (inch)	0.2 (0.0078)
Thinnest single track	mm (inch)	2-2.5 (0.078-0.098)
Layer thickness	mm (inch)	0.5 (0.02)
Roughness	R_a (µm)	As-built: >25
Tensile strength	R^m (MPa)	1295
Yield strength	$R^{p0,2}$ (MPa)	504.99±20
Young modulus	E (GPa)	
Elongation at break	A (%)	11.19±1
Hardness	HRC	42.7±3.18

Nickel Alloys

In625

MATERIAL PROPERTIES	APPLICATIONS
High corrosion resistance at high temperatures	Oil and Gas
High creep resistance	Marine
Good Ductility	Aerospace
High strenght	Automotive
	Chemical
	Energy

Chemical Composition (wt-%)

Ni	Cr	Mo	Nb	Fe	Co	Si	Mn	Ti	Al	C	S	P
Balance	20-23	8-10	3.15-4.15	5	1	0.5	0.5	0.4	0.4	0.1	0.015	0.015

MECHANICAL DATA	UNIT	AS-BUILT
Particles Size Distribution	µm (inch)	45-180 (0.0017-0.007)
Density	g/cm^3	7.9
Part Accuracy	mm (inch)	0.2 (0.0078)
Thinnest single track	mm (inch)	2-2.5 (0.078-0.098)
Layer thickness	mm (inch)	0.5 (0.02)
Roughness	R_a (µm)	As-built: >25
Tensile strength	R^m (MPa)	875±6
Yield strength	$R^{p0,2}$ (MPa)	543±25
Young modulus	E (GPa)	215±25
Elongation at break	A (%)	32±3
Hardness	HRB	100±5

Nickel Alloys

In718

MATERIAL PROPERTIES	APPLICATIONS
High corrosion resistance at high temperatures	Oil and Gas
High creep resistance	Turbine Blades
Good Ductility	Aerospace
High strenght up to 700°C	Heat Exchangers
	Energy

Chemical Composition (wt-%)

Ni	Cr	Fe	Mo	Nb+Ta	Al	Ti
Balance	19.2	18.5	3.4	5.5	0.7	1.2

MECHANICAL DATA	UNIT	AS-BUILT
Particles Size Distribution	µm (inch)	45-106 (0.0017-0.0041)
Density	g/cm^3	4.40
Part Accuracy	mm (inch)	0.2 (0.0078)
Thinnest single track	mm (inch)	2-2.5 (0.078-0.098)
Layer thickness	mm (inch)	0.5 (0.02)
Roughness	R_a (µm)	As-built: >25
Tensile strength	R^m (MPa)	958±32
Yield strength	$R^{p0,2}$ (MPa)	703±8
Young modulus	E (GPa)	160
Elongation at break	A (%)	34.8±1.6
Hardness	HRC	28.7±3.57

Titanium Alloys

Ti6Al4V*

MATERIAL PROPERTIES	APPLICATIONS
High Biocompatibility	Medical
Excellent specific strength	Motorsport
High Corrosion resistance	Aerospace
Low thermal conductivity and expansion	High value Sport components

Chemical Composition (wt-%)

Ti	Al	V	C	O	N	Fe	H	Y	Others
Balance	6.3	4.0	0.06	0.08	0.01	0.05	0.001	0.005	0.4

MECHANICAL DATA	UNIT	AS-BUILT
Particles Size Distribution	µm (inch)	44-106 (0.0017-0.0042)
Density	g/cm^3	2.36±0.01
Part Accuracy	mm (inch)	0.2 (0.0078)
Thinnest single track	mm (inch)	2.3 (0.091)
Layer thickness	mm (inch)	0.7 (0.028)
Roughness	R_a (µm)	As-built: 20.13±2.53
Tensile strength	R^m (MPa)	1035±21.2
Yield strength	$R^{p0,2}$ (MPa)	911±9.9
Young modulus	E (GPa)	114
Elongation at break	A (%)	8±0.3
Hardness	HRC	46

** Processable only with inert chamber option*

Steel Application

Repairing	
SECTOR	AUTOMOTIVE
INTENDED USE	MOLD REPAIRING
TECHNICAL DETAILS	**Build time*:** 10 minutes **Layer thickness:** 0.5 mm (0.02 inch) **Material:** AISI316L **Part Dimension (X-Y-Z):** 300x80x80 mm

*Build Speed is depending on the application. It is influenced by many factors and it is not related only to the part volume.

Nickel Application

Repairing	
SECTOR	OIL & GAS / AEROSPACE
INTENDED USE	TURBINE BLADE
TECHNICAL DETAILS	**Build time*:** 12 minutes **Layer thickness:** 0.5 mm (0.02 inch) **Material:** In625 **Part Dimension (X-Y-Z):** 80x20x250 mm

*Build Speed is depending on the application. It is influenced by many factors and it is not related only to the part volume.

Steel Application

Repairing	
SECTOR	ENERGY
INTENDED USE	REPAIRING BLADES
TECHNICAL DETAILS	**Build time*:** 10 minutes for each blade **Layer thickness:** 0.5 mm (0.02 inch) **Material:** 17-4PH **Dimension of the reported part:** 50 (L) x 36 (max H) mm

*Build Speed is depending on the application. It is influenced by many factors and it is not related only to the part volume.

Steel Application

Adding features	
SECTOR	NAVAL
INTENDED USE	ADDING PROPELLER BLADES
TECHNICAL DETAILS	**Build time*:** 8 hours **Layer thickness:** 0.5 mm (0.02 inch) **Material:** AISI316L **Part Dimension:** 95 (diameter) x 60 mm (height)

*Build Speed is depending on the application. It is influenced by many factors and it is not related only to the part volume.

Prima Additive at your disposal: application study

Additive is competitive. This is our philosophy, but also our commitment to advancing the industry by reducing the barriers to entry in Additive Manufacturing. We guide and help customers to develop their right additive application. We are open to investigate and produce new materials suitable for additive manufacturing in order to accommodate your specific needs.

Do you want to know if additive manufacturing is the best solution for your business? Contact Prima Additive, we can help you establish materials, machines and production process that most benefits your business.

How to get a free application study?

1. Go to
https://www.primaadditive.com/en/additive-manufacturing/request-application-assessment

2. Upload on our website your 3D model

3. Choose the additive process
(Powder Bed Fusion or Direct Energy Deposition)

4. Choose the material

5. Our expert engineers will analyze your business case and they will send you the full application study tailored to your needs. **For free.**

Contacts

STEP INTO THE NEW FRONTIER OF MANUFACTURING WITH PRIMA ADDITIVE

Contact us for more details about the Prima Additive product range and discover how your business could be future-ready as early as today.

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www.primaadditive.com

Concept and design Ars Media

primaadditive.com

Prima Additive