AM CORRAX

UDDEHOLM AM CORRAX

Edition 20220524

AM CORRAX

AM Corrax is a stainless steel made for Additive Manufacturing with a unique set of properties making it the ultimate choice for tools where superior corrosion resistance combined with high hardness is needed. These properties makes it perfectly suitable for tools for plastic moulds including demanding applications such as moulds for medical parts, corrosive plastics i.e. PVC and parts made of rubber material.

AM Corrax offers high polishability in terms of surface finish and ease to process resulting in a high gloss surface suitable for challenging tooling applications.

The corrosion resistance is also beneficial when implementing complicated conformal cooling designs due to minimised risk for clogging of cooling channels, oxide layers reducing the cooling efficiency or corrosion initiated cracks.

The favourable chemical composition makes AM Corrax easy to process in additive manufacturing processes to get excellent printing results and excellent material properties.

GENERAL

AM Corrax offers several advantages compared to most AM tool steels:

- Flexible hardness, 36 – 50 HRC, achieved by an ageing treatment in the temperature range 425 – 600°C
- Good dimensional stability during the aging treatment
- Excellent polishability
- No hard "white" layer after EDM
- Excellent corrosion resistance
- Easy to process in laser powder-bed as well as laser metal deposition AM equipment

APPLICATIONS

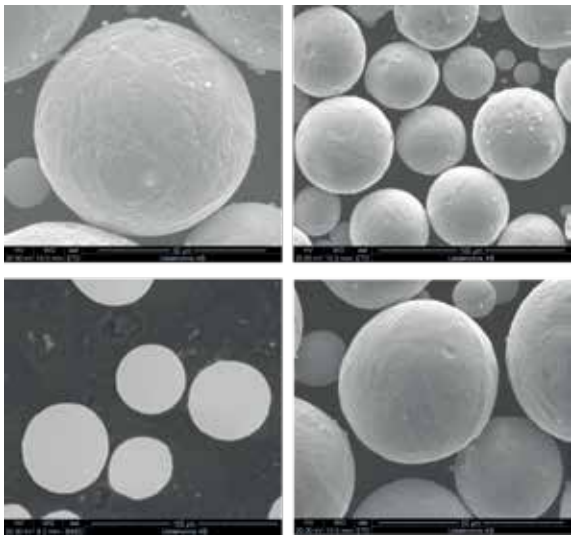
- Injection moulds for
  – corrosive plastics
  – rubber
  – medical and food industry
- Extrusion dies
- Plastic processing
  – screws
- Engineering parts

POWDER CHARACTERISTICS

CHEMICAL COMPOSITION

Typical analysis %	C	Si	Mn	Cr	Ni	Mo	Al
	0.03	0.3	0.3	12.0	9.2	1.4	1.6

O < 225 ppm



SHAPE DISTRIBUTION AND DENSITY

Sphericity	0.94
Aspect Ratio	0.90
Apparent density, kg/m³	4300
Tap density, kg/m³	4700
True density, kg/m³	7610

PARTICLE SIZE AND SHAPE DISTRIBUTION

AM Corrax has a sieved grain size that is between 20 and 50 µm with a median size of 38 µm so the distribution is on the bigger side of the spectra to suit most additive manufacturing equipment.

D10	D50	D90
25	38	53

* ≤ 10 µm ~ 0.7% *≥ 65 µm ~ 3%

PROPERTIES

PHYSICAL DATA

The data was acquired from samples processed to > 99.5 % density. Measured at room temperature on solution treated and aged material with a hardness of 48HRC.

Temperature	20°C	200°C	400°C
Density kg/m³	7 700	-	-
Modulus of elasticity KN/mm²	200 000	190 000	170 000
Coefficient of thermal expansion per °C from 20°C	-	11.7×10^{-6}	12.3×10^{-6}
Thermal conductivity W/m°C	-	18	21

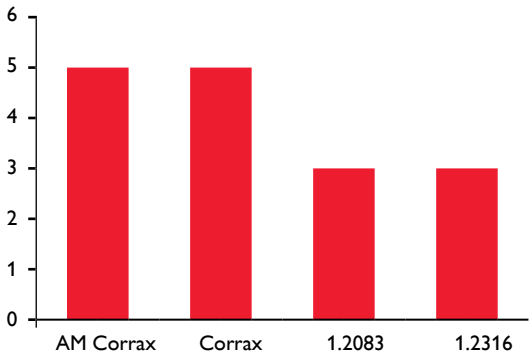
MECHANICAL DATA

	As build 34 HRC	Solution treated ~34 HRC	Aged to ~40 HRC	Aged to ~46 HRC	Aged to ~50 HRC
Yield strength, $R_{p0.2}$ MPa	760	700	1000	1400	1600
Tensile strength, R_m MPa	1150	1100	1200	1500	1700
Elongation A5%	16	15	16	11	10
Compressive strength, MPa	900	900	1300	1600	1800

CORROSION RESISTANCE

AM Corrax has a very good corrosion resistance, fully matching the conventionally manufactured Corrax and better than the corrosion resistant standard grades used for plastic moulding.

AM Corrax will withstand most corrosive plastics and diluted acids. A mould insert made of AM Corrax will have good resistance to humid working and storage conditions. AM Corrax shows better resistance to stress corrosion cracking than standard hardenable corrosion resistant steel grades.



WEAR RESISTANCE

Due to high hardness and fine microstructure AM Corrax has an excellent wear resistance towards most media.

POLISHING

AM Corrax offers extremely high polishability that results in excellent surface finish and a high gloss polished surface. When processed correctly AM Corrax fully matches conventionally produced tool steels with its low amount of porosity and inclusions giving it perfect surfaces for high demanding tooling applications.

AM PROCESSING

AM Corrax can be easily and efficiently processed in most powder-bed laser additive manufacturing equipment.

Achieving optimum material performance could require customisation of process parameters for each printer.

Some examples of process parameters are shown below and for further information please contact your nearest ASSAB office.

	SLM 280	Trumpf 1000	EOS M290	Concept-laser M2
Layer thickness, µm	30	20	30	30
Laser power, W	200	155	170	130
Scan speed, mm/s	720	814	1250	150
Hatch distance, mm	0.12	0.07	0.10	0.10
Hatch mode	Stripes	Checker board	Stripes	Stripes
Build plate temperature	No heating required	No heating required	No heating required	No heating required

POST PROCESSING

SOLUTION TREATMENT

In the as-build condition AM corrax material can contain up to 20 % retained austenite. The retained austenite content can be reduced to acceptable limits ~ 4% after solution treatment.

Solution treatment should be performed at 850°C, holding time 30 minutes and then cool in air.

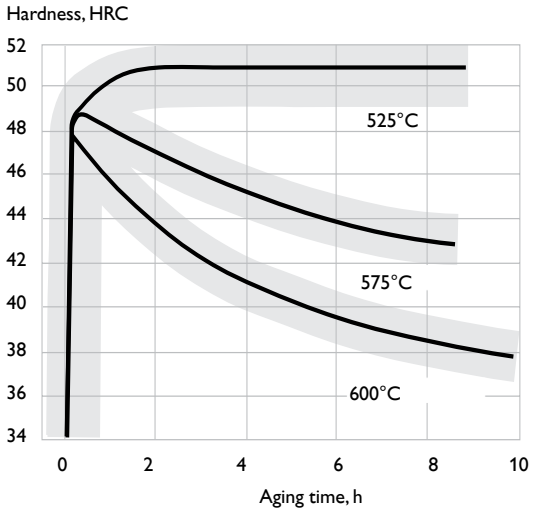
AGING

Suitable aging parameters can be obtained from the figure below. Aging time means the time at the ageing temperature after the tool is fully heated through.

When the aging time is reached, cool the tool in air to room temperature. Aging at high temperature gives a better toughness compared with ageing to the same hardness at a lower temperature.

AM Corrax can also be used in as-build condition but higher hardness is obtained by aging.

Aging Temperature/time	Hardness
525°C/4 h	49 - 52 HRC
575°C/4 h	44 - 47 HRC
600°C/4 h	40 - 43 HRC



STRESS RELIEVING

Stress relieving cannot be performed as for other steel grades since an increase in temperature results in a higher hardness because of ageing effect.
AM Corrax does not need stress relieving after the AM process.

DIMENSIONAL CHANGE

Aging results in a small and uniform decrease in volume. The following shrinkage can be expected during aging.

	Dimensional change%		
Aging	Longitudinal direction	Transversal direction	Short transversal direction
525°C/4 h ~ 50 HRC	-0.07	-0.07	-0.07
575°C/4 h ~ 46 HRC	-0.09	-0.09	-0.09
600°C/4 h ~ 40 HRC	-0.14	-0.14	-0.14

ELECTRICAL DISCHARGE MACHINING — EDM

Corrax can be EDM'd in the same way as ordinary tool steels. The "white layer" will, however, not be as hard and is therefore more easily removed.

GRINDING AND POLISHING

A general grinding wheel recommendation is given below. More information can be found in the "Grinding of Tool Steel" brochure.

Type of grinding	Delivery condition
Face grinding straight wheel	A 46 GV
Face grinding segments	A 36 FV
Cylindrical grinding	A 60 JV
Internal grinding	A 60 IV
Profile grinding	A 120 JV

When good surface finish is required a SiC-wheel could be an alternative.

POLISHING

AM Corrax exhibits excellent polishability behaviour in both as-built and heat-treated conditions. A slightly different and more demanding technique is needed when polishing corrosion-resistant tool steels. Usually more steps are required between fine grinding and polishing stages.

On the contrary, for AM Corrax after rough and fine grinding it is possible to achieve high quality gloss surface finish with only three steps between lapping and polishing stages.

PHOTO-ETCHING

Corrax has a very good corrosion resistance and a special process is thus required for chemical photo-etching. Fine patterns with shallow depths <0.04 mm (0.002") are readily achievable.

OTHER PRODUCTS AND SERVICES

BUILD PLATES

To get optimal quality of your powder bed builds is the best choice to use Corrax plates. Pre-machined build plates are available in dimensions of 300x300x50 mm.

LMD POWDER

AM Corrax can be used in laser metal deposition machines and is for that purpose available in the size fraction 50 - 150 µm.

For further information please contact your nearest ASSAB office.

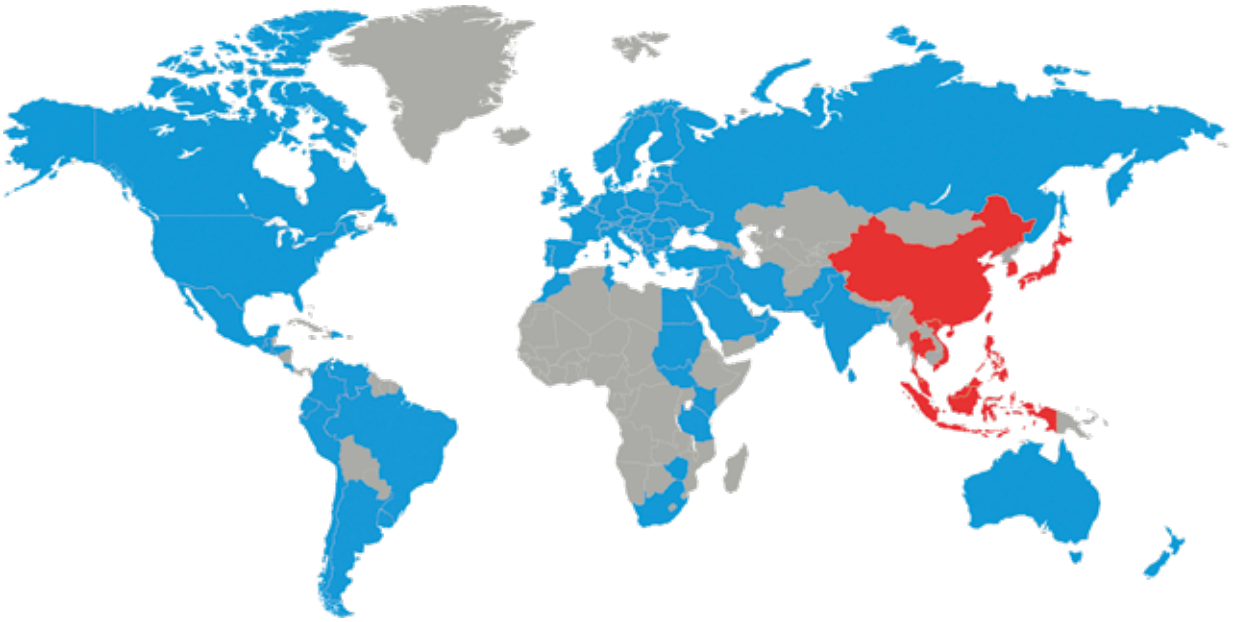
POWDER INVESTIGATIONS

AM Corrax is a very robust powder with consistent quality and properties that can be re-used several times without powder degradation.

At ASSAB we have a fully equipped powder laboratory to fully secure the quality of the powder so if you need help in qualifying your used powder to insure quality please contact your nearest ASSAB office.

FURTHER INFORMATION

Please,contact your nearest ASSAB office for further information on the selection, heat treatment, application and availability of ASSAB tool steels.



Choosing the right steel is of vital importance. ASSAB engineers and metallurgists are always ready to assist you in your choice of the optimum steel grade and the best treatment for each application. ASSAB not only supplies steel products with superior quality, we offer state-of-the-art machining, heat treatment and surface treatment services to enhance steel properties to meet your requirement in the shortest lead time. Using a holistic approach as a one-stop solution provider, we are more than just another tool steel supplier.

ASSAB and Uddeholm are present on every continent. This ensures you that high quality tool steel and local support are available wherever you are. Together we secure our position as the world's leading supplier of tooling materials.

For more information, please visit
www.assab.com

UDDEHOLM
a voestalpine company

ASSAB