GTV Verschleißschutz GmbH
Gewerbegebiet “Vor der Neuwiese”
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Sensors for stable high precision laser cladding processes

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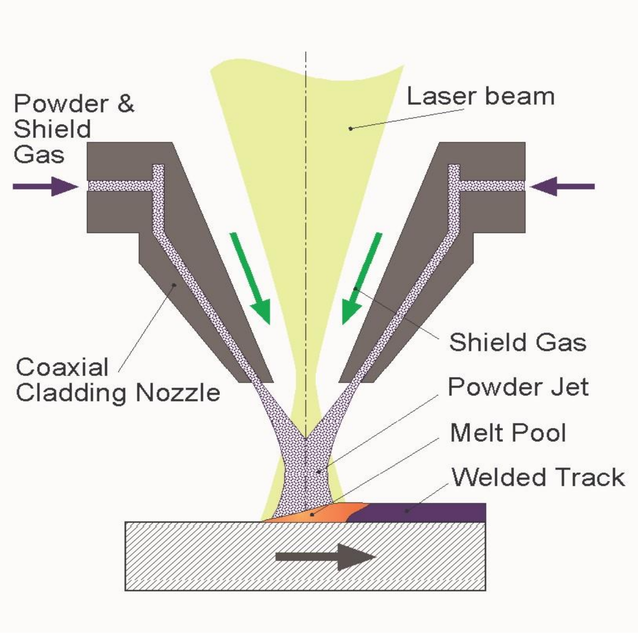
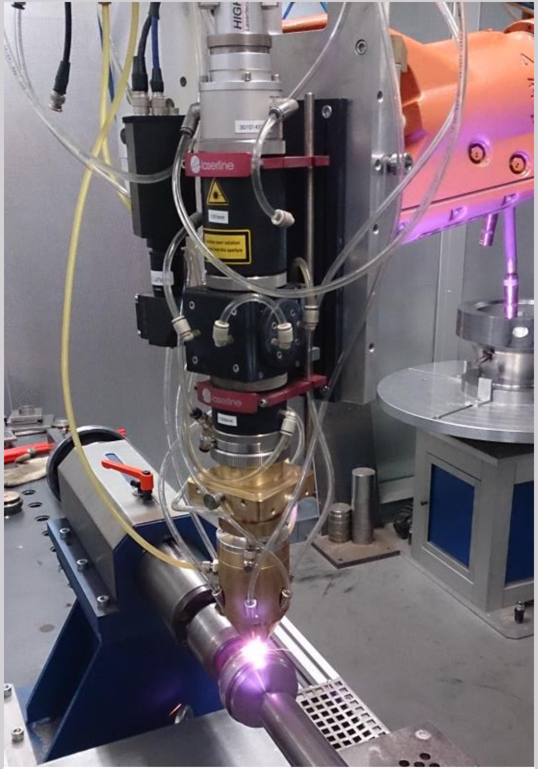
Laser Cladding Characteristics

- Metallurgical bonding between substrate and cladding
- High precision of heat transfer
  → Minimum dilution with base material possible
  → Minimum dimensions of heat affected zones, thermal treatment and distortion of base material possible
- Precise material deposition
- High process stability and reproducibility
  → High homogeneity of microstructure
  → Pre-condition for automation given
- Low porosity achievable
- But: Tolerances (temperature, working distance) take strong influence!



Laser cladding with coaxial powder feed

Laser Power Control

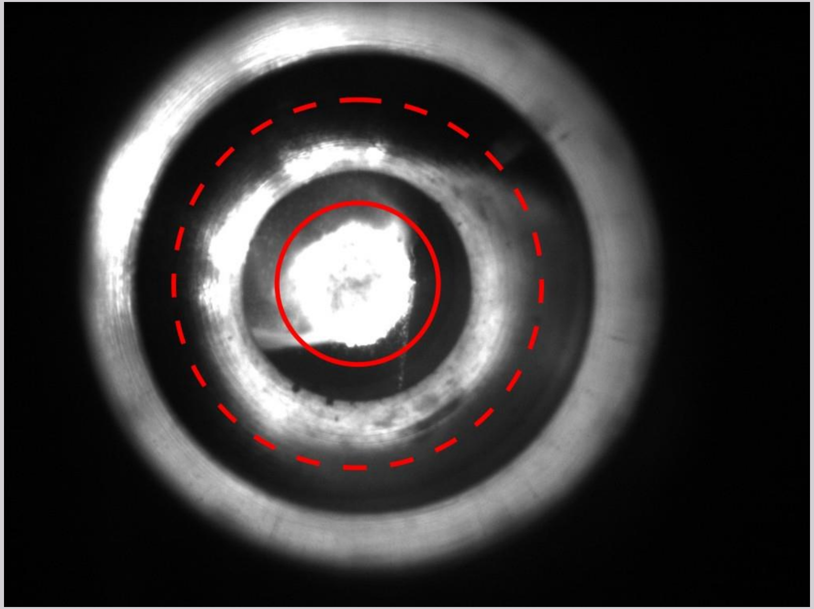


CCD camera (mounted)

- Evaluation of emission from melt pool
- Compensation of increasing or decreasing component temperature
- Prevention of optics thermal overload

Evaluation unit

LPowC



- User defined (circular) emission evaluation areas for I: laser power control and II: optics protection
- Definition of emission value limits based on recordings of optimal process
- LPowC produces digital signals that indicate violation of limits
- Laser cladding installation PLC uses digital signals to realize closed loop control of laser power

LPowC cladding tests

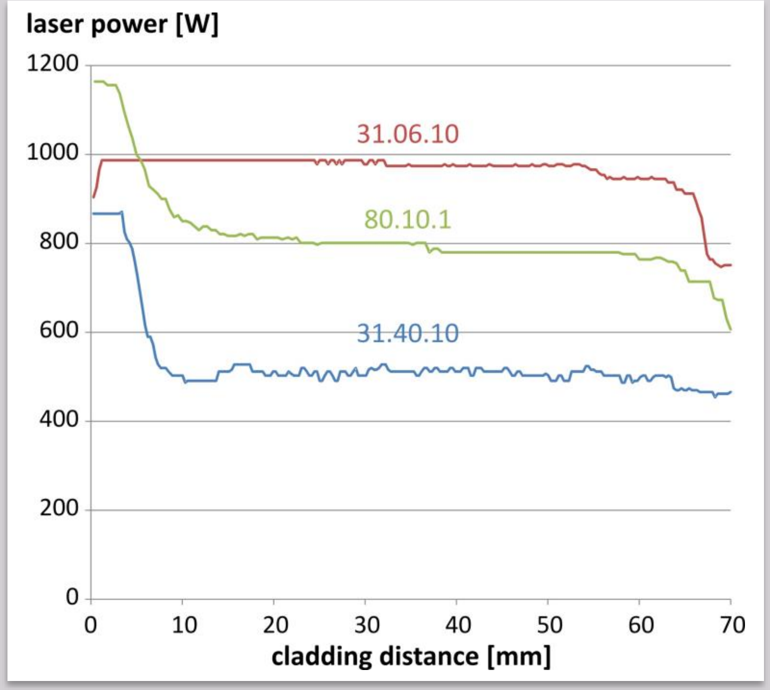
- 316L steel, 28 x 1.2 mm
- 3 types of powders:
  FeCrV15, +63 -180 µm
  NiBSi 22HRC, +20 -53 µm
  Stellite®6, +63 -150 µm
- Cladding thickness:
  0.65 - 1.0 mm

LPowC cladding tests

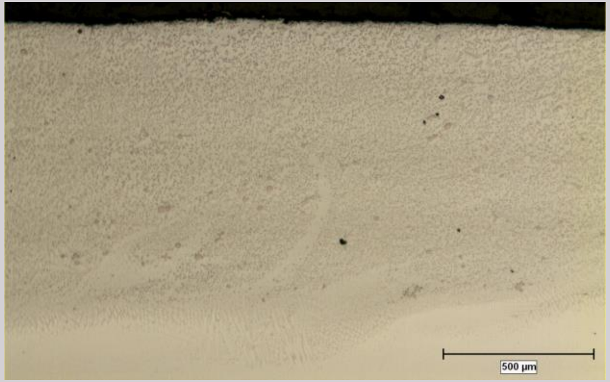
FeCrV15

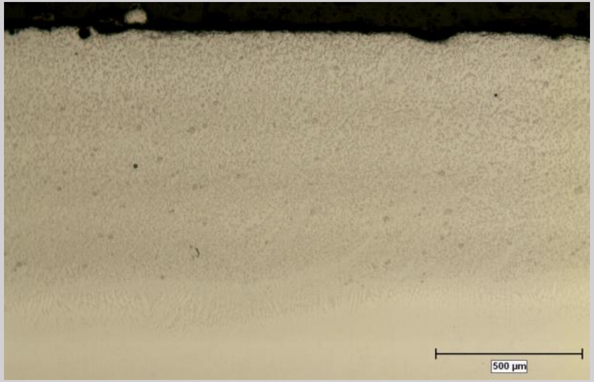
NiBSi 22HRC

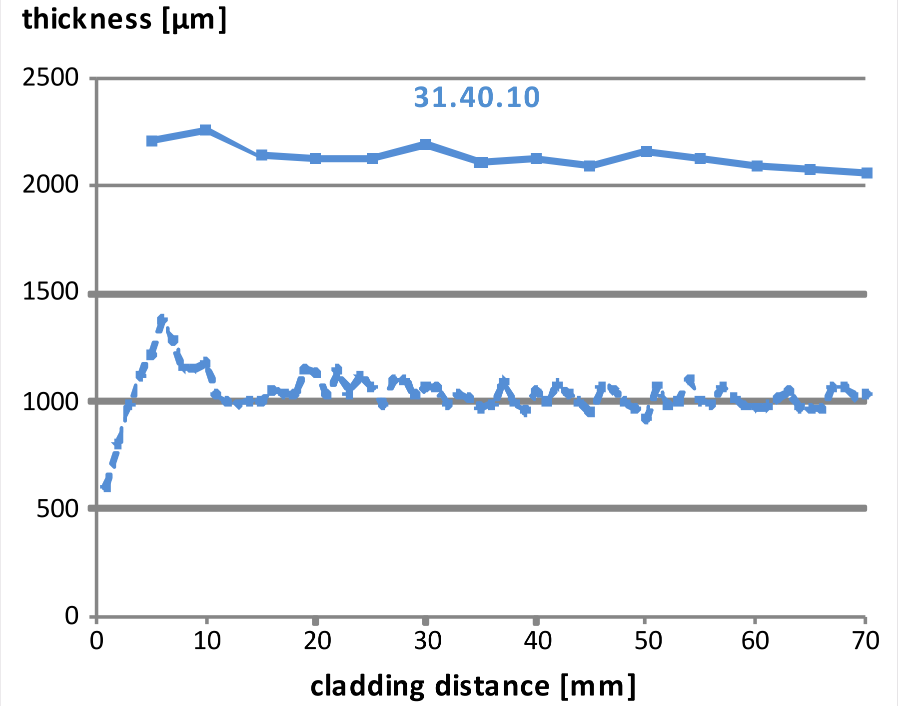
Stellite®6



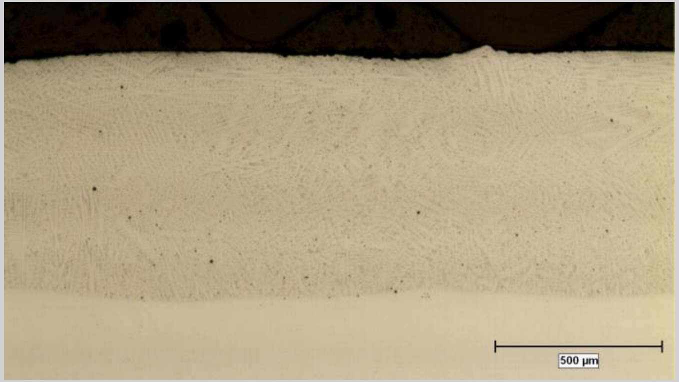
LPowC FeCrV15

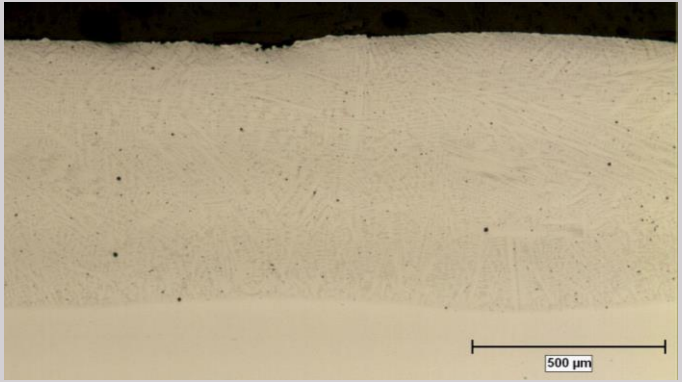


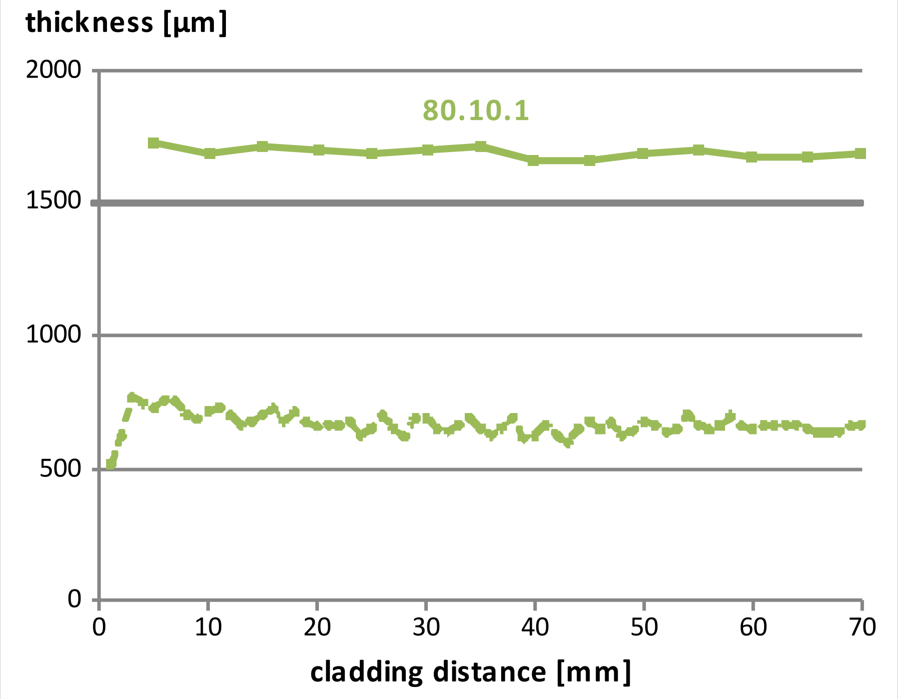




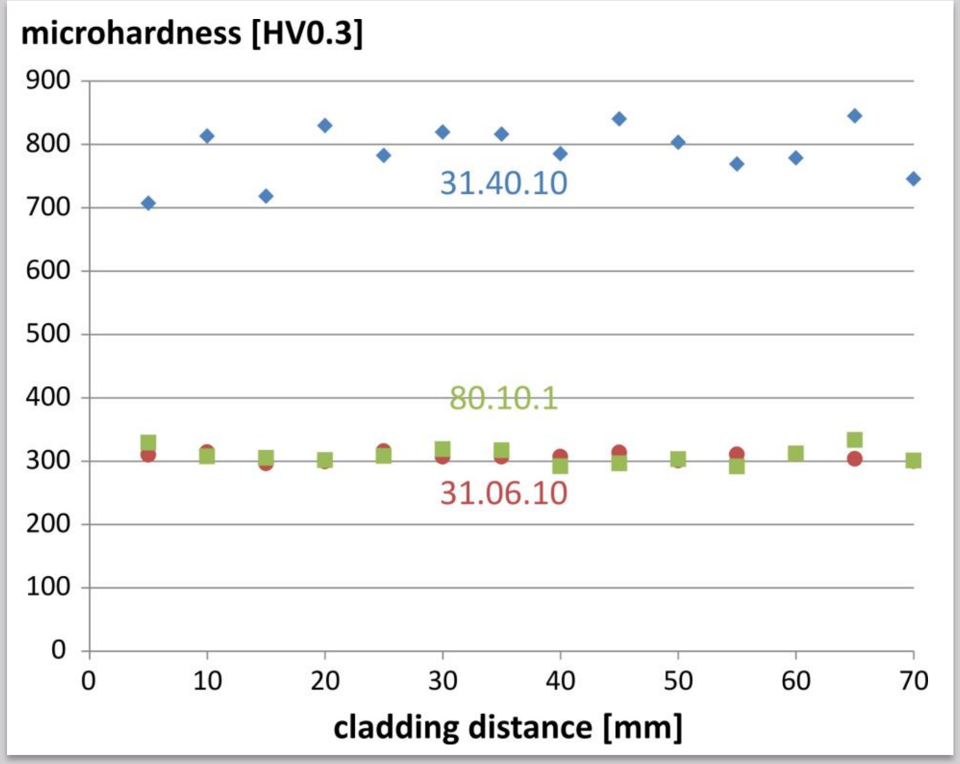
LPowC NiBSi 22 HRC



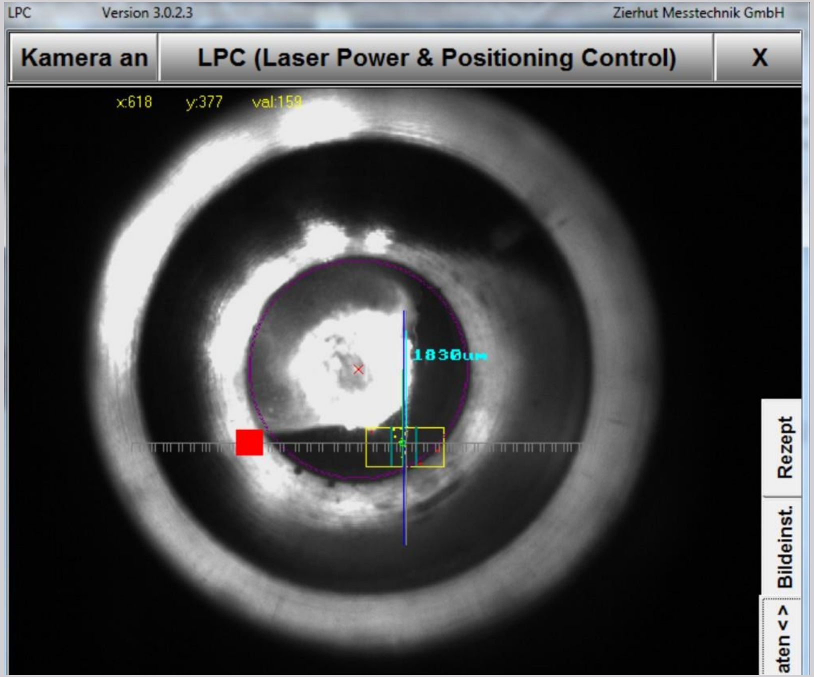




LPowC Hardness

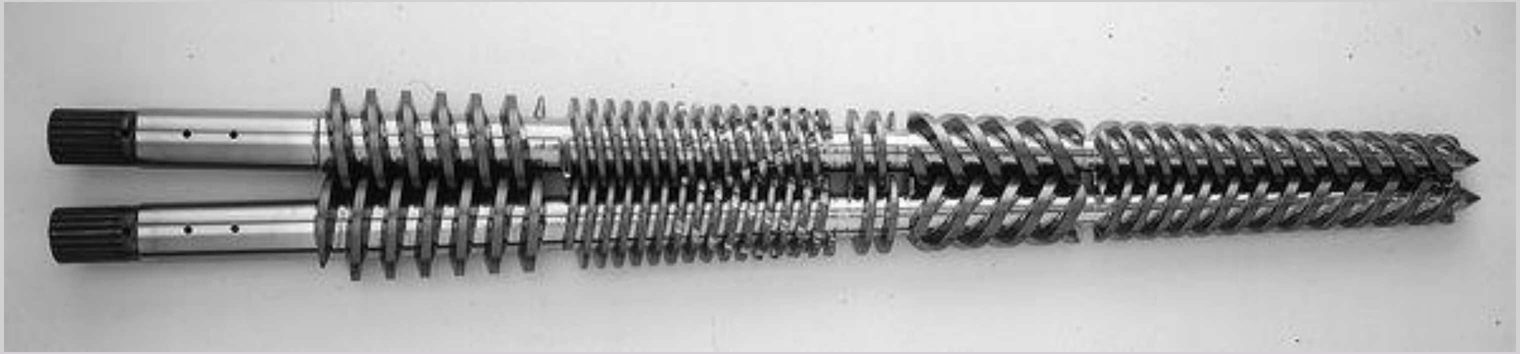


LPosC



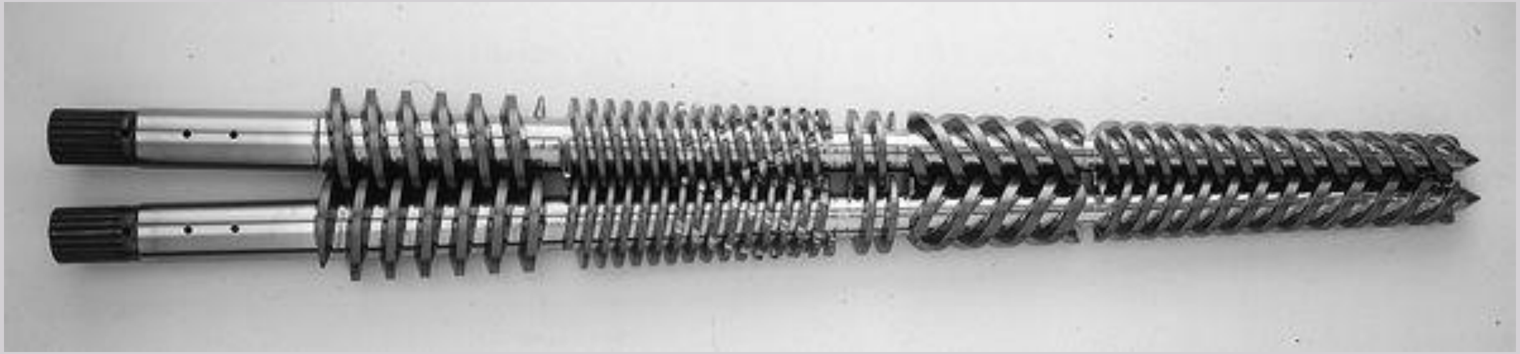
- Detection of laser beam focus center by powder nozzle bore center
- Definition of area of interest (yellow) and grey scale value & gradient criteria for automatic edge detection (blue)
- Error correction function by maximum permissible deviation of edge position and inclination compared to previous measurement
- Setting of optimal reversal points based on pre-investigations

LPosC

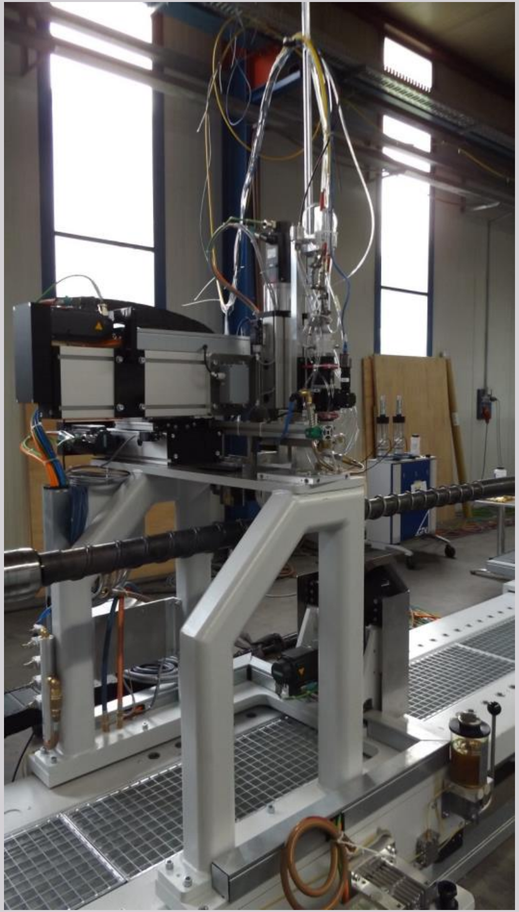


- High precision of cladding process permits near net shape cladding and minimizes hard machining time & costs
- Screw flight geometry alteration along screw axes and conicity result in extensive handling programming demands
- Susceptibility to cracking of typical cladding material usually requires pre-heating and temperature control during cladding process

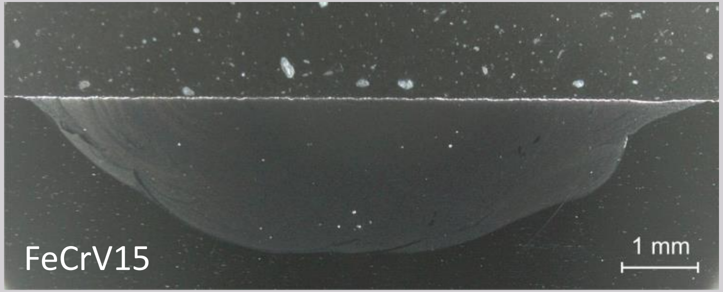
LPosC



- Temperature deviations during cladding process result in undefined position of screw flights
- Concentricity tolerances of small diameter screws require compensation in cladding head movement to keep working distance in acceptable range



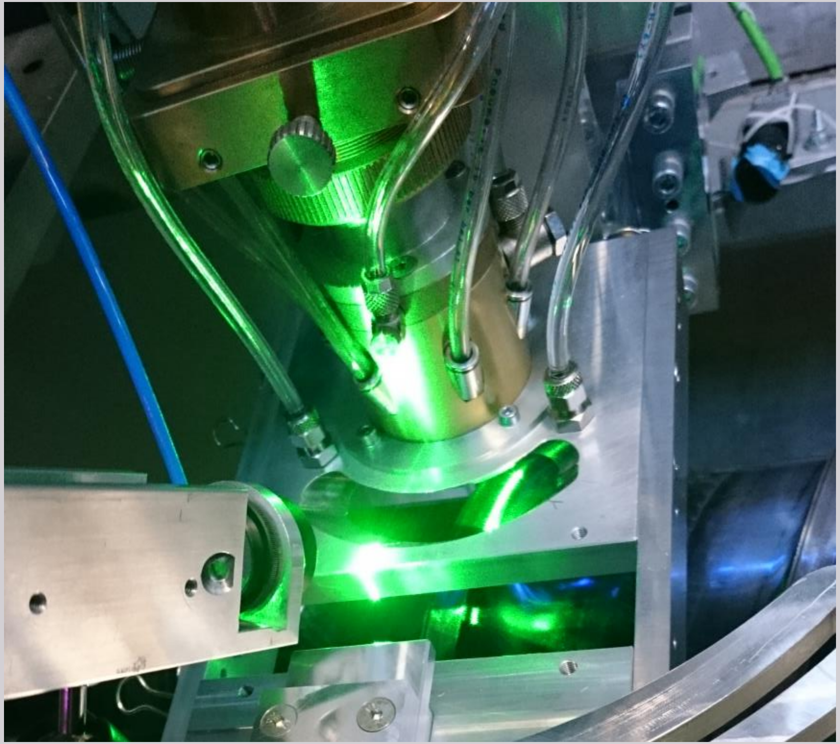
LPosC



Extruder screw cladding center, including:

- LPosC edge detection for automatic compensation of thermally induced screw elongation or shrinkage
- Concentricity tolerance compensation in vertical and horizontal direction based on online screw surface monitoring (2D laser distance meters)

LPosC



- Triggered component illumination for edge detection

Summary

- LPowC permits production of claddings with homogeneous microstructure, shape and microhardness despite extreme change of component temperature during cladding
- If inadequate parameters are chosen, LPowC will keep inadequate process constant
- LPosC is capable of detecting groove edges and adjust laser cladding head positioning due to thermally induced component elongation / shrinkage
- **Learn more about laser cladding process control @ GTV booth!**

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Thank you very much for your attention!