

COLD SPRAYING IN MOTION



June 18 - 19, 2013 – Helmut Höll – COLD SPRAYING IN MOTION

OUTLINE

- Spray line
- single layer
- multiple layer - part
- temperature equivalent of velocity
- examples

...

...

COLD SPRAYING IN MOTION

- Velocity of particle [m/s]
- Motion speed of the nozzle [mm/s]
- Volume spray rate [mm³/s]
- Area velocity [mm²/s]

- Thickness [mm]
- Feedrate [g/s]
- Spot diameter [mm]
- ...

- volume rate -> 0,7 dm/h => 3 kg/h => 50 gr/min
- motion velocity -> 100 mm/s - 1000 mm/s (-3000mm/s)
- Spot diameter -> 2 to 10 mm



- volume rate -> 0,7 dm/h => 3 kg/h => 50 gr/min
- motion velocity -> 100 mm/s - 1000 mm/s (-3000mm/s)
- Spot diameter -> 2 to 10 mm



100mm/s -> 180 um

300mm/s -> 60 um

500mm/s -> 36 um

750mm/s -> 24 um

1000mm/s -> 18 um

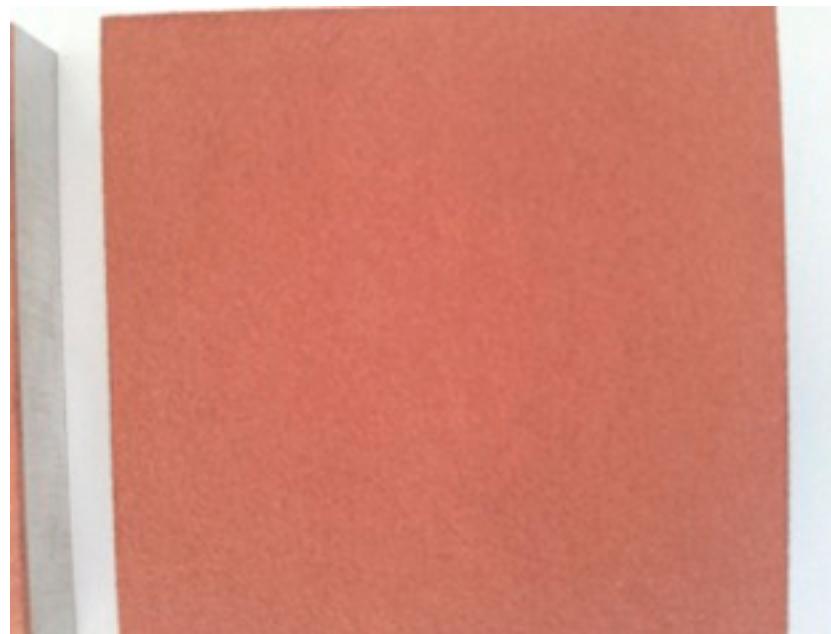
- feedrate => 50 gr/min
- motion velocity => 100 mm/s
- spot diameter => 7 mm
- step size => 5 mm



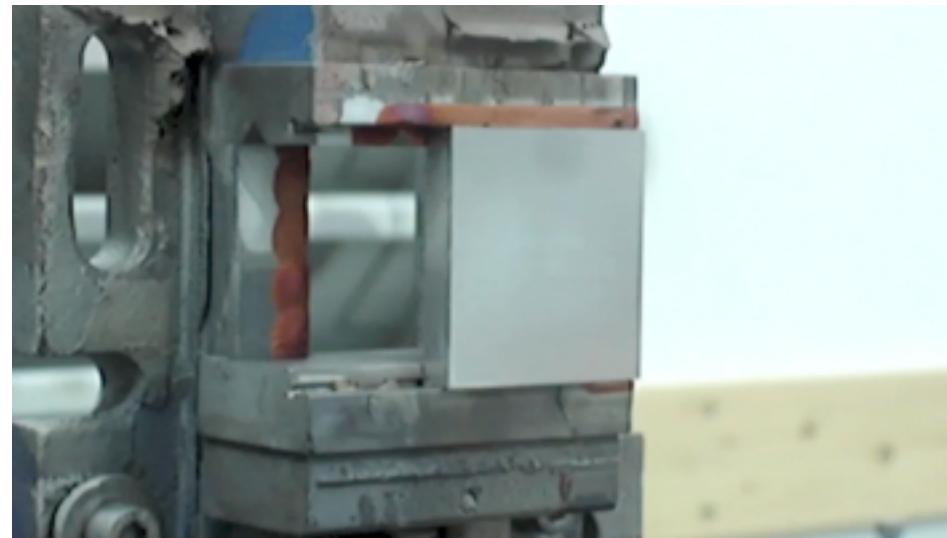
- feedrate => 50 gr/min
- motion velocity => 500 mm/s
- spot diameter => 7 mm
- step size => 1 mm



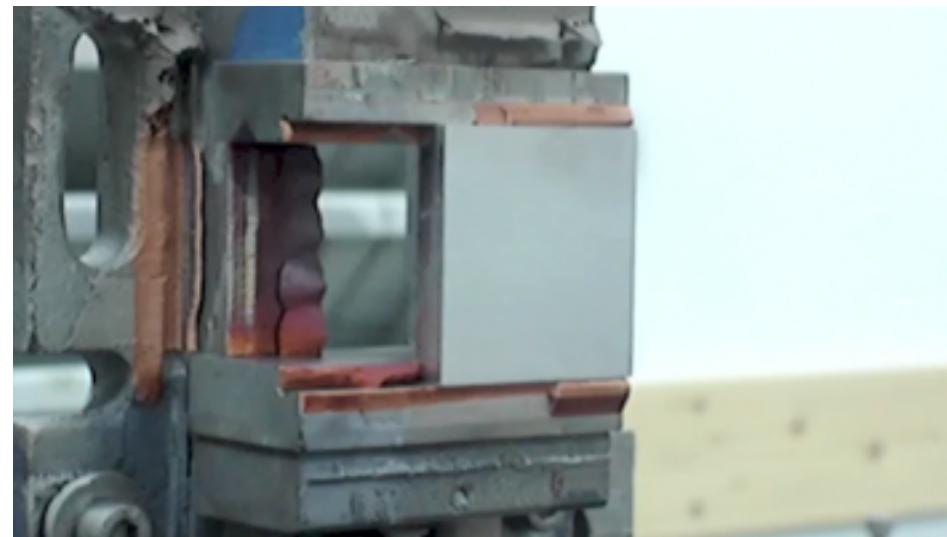
- feedrate => 50 gr/min
- motion velocity => 1000 mm/s
- spot diameter => 7 mm
- step size => 0,5 mm



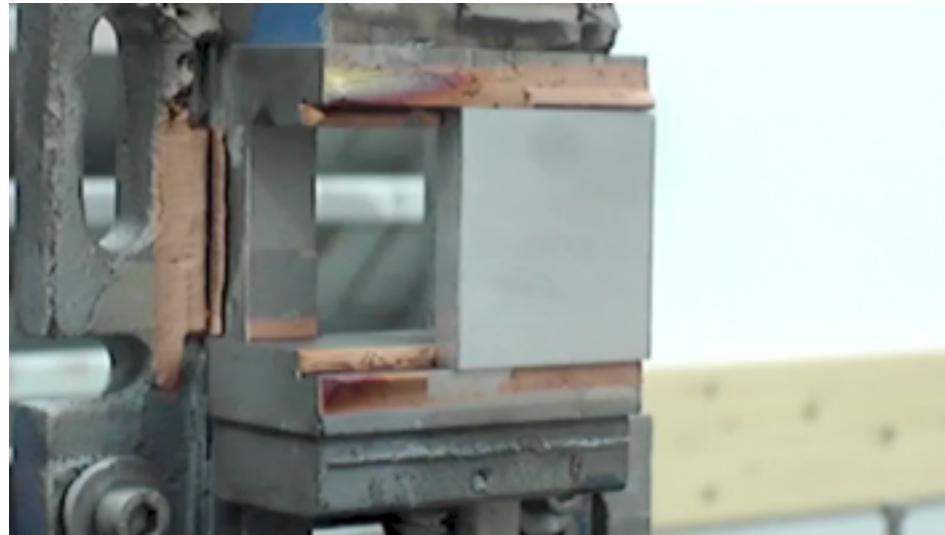
- feedrate => 50 gr/min
- motion velocity => 100 to 1000 mm/s
- spot diameter => 7 mm
- step size => 5,0 to 0,5 mm



- feedrate => 50 gr/min
- motion velocity => 100 to 1000 mm/s
- spot diameter => 7 mm
- step size => 5,0 to 0,5 mm



- feedrate => 50 gr/min
- motion velocity => 100 to 1000 mm/s
- spot diameter => 7 mm
- step size => 5,0 to 0,5 mm



Formula: Kinetic Energy → $E_{kin} = \frac{1}{2}mv^2$

Formula: Thermal Energy → $E_{th} = cmT$

Formula: E_{kin} vs. dT → $dT = \frac{1}{2} \frac{v^2}{c}$



Temperature equivalent of velocity:

Copper $v_{opt} 600 \frac{m}{s}$ → $c_{Cu} = 385 \frac{J}{Kg K}$ → $dT = 385^\circ$

Tantalum $v_{opt} 575 \frac{m}{s}$ → $c_{Ta} = 140 \frac{J}{Kg K}$ → $dT = 1180^\circ$

Aluminum $v_{opt} 650 \frac{m}{s}$ → $c_{Al} = 897 \frac{J}{Kg K}$ → $dT = 235^\circ$

- conclusion
- there is a optimal motion velocity
- motion strategy to avoid temperatures
- energy management is a new chapter
- ...
-

completely new designed unit

Performance:

800°C or 1100°C gas temperature
@ 50 bar gas pressure

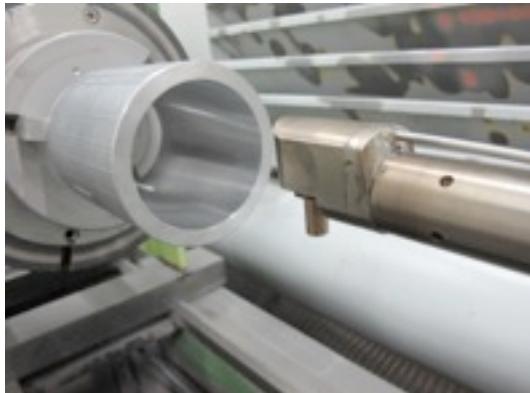
heating performance suitable to
customers application

Integration of 2 or 3 PF's
simultanious powder feeding

New software:

Recipe managment
Profi-Bus/Net integrated





cold spray of ID's
down to Ø 80 mm



central feed adapter



powder injection in the center of the main gas flow

position of injection is
Adjustable

influence on temperature
and velocity of particles



EXAMPLE

