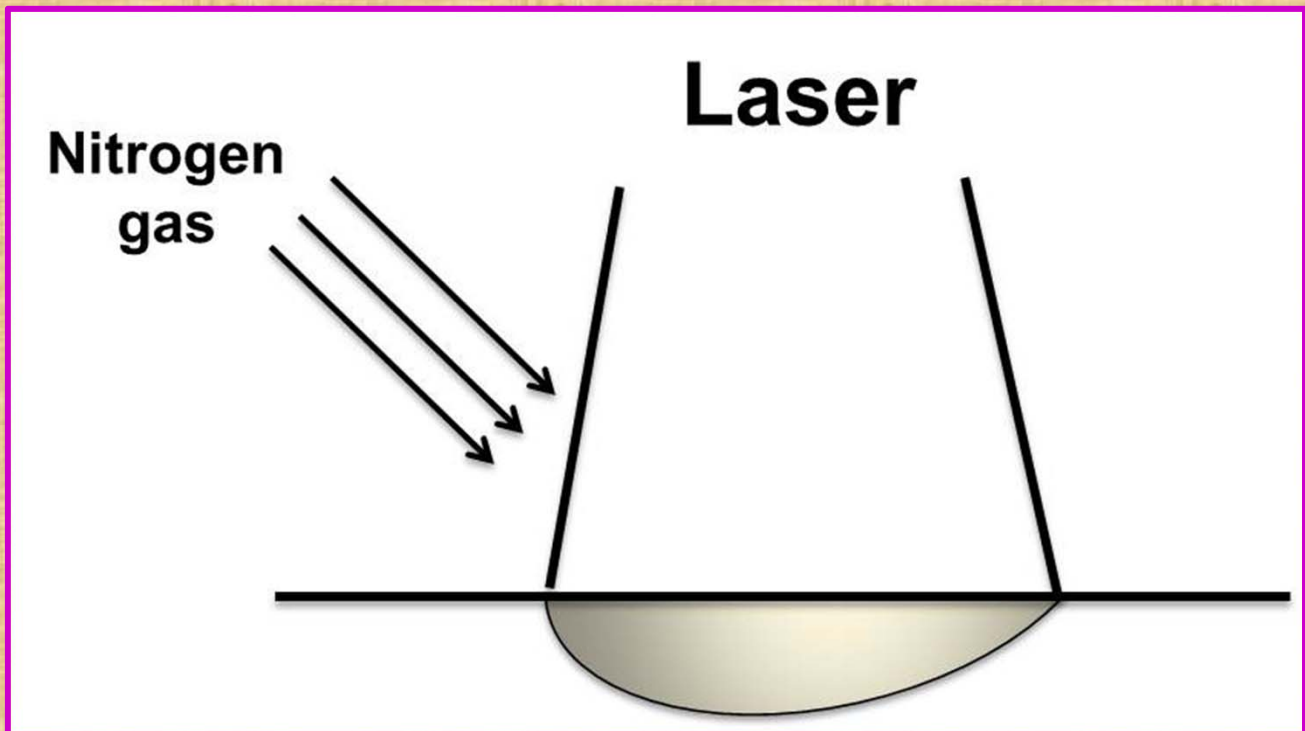


**Laser nitriding  
Laser surface remelting  
Laser cladding  
of Ti-6Al-4V**

**Thuan Dinh Nguyen**

# Laser nitriding of Ti-6Al-4V

## \* Method



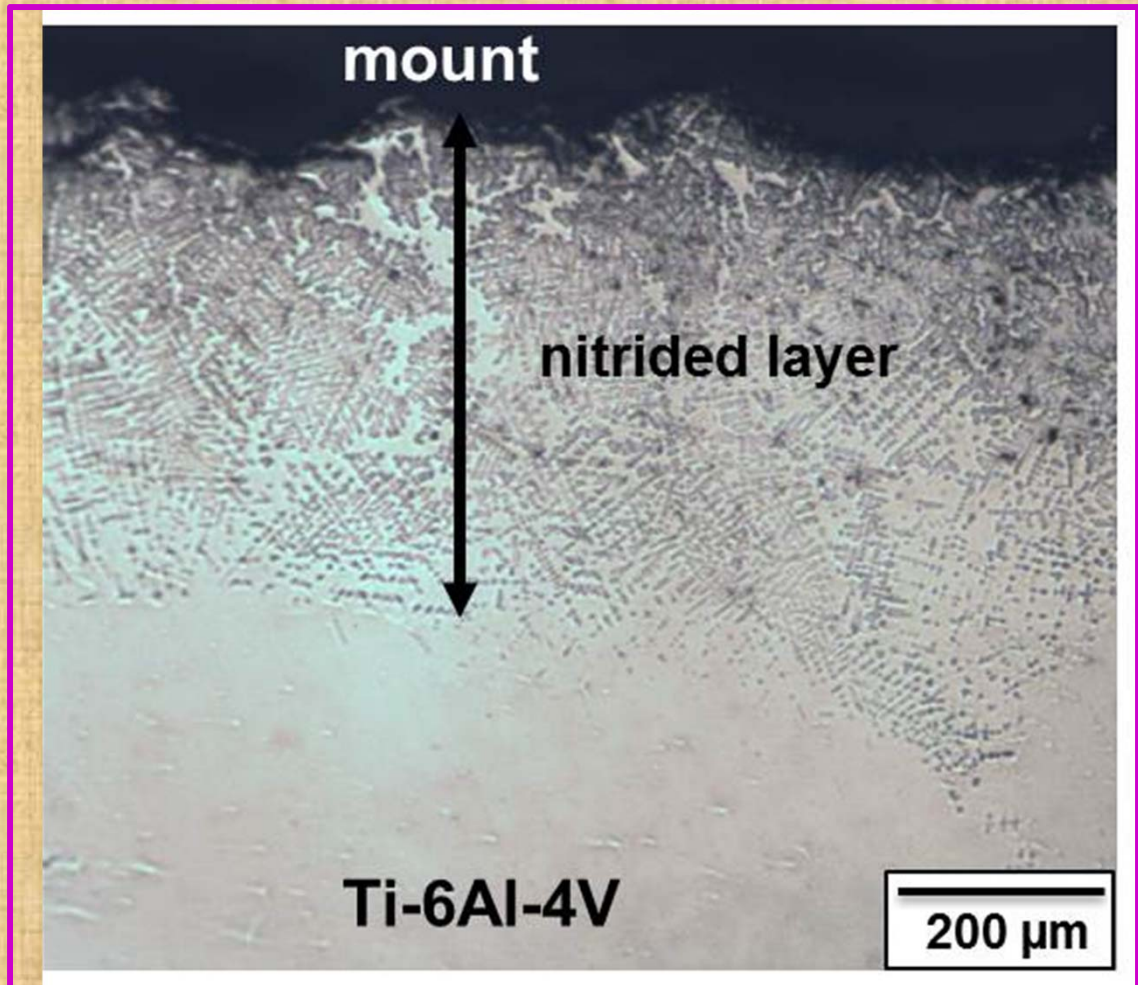
## \* Equipment

- Fiber laser.
- CSTPQ center in La Pocatiere, Quebec.



# Laser nitriding of Ti-6Al-4V

## \* Results

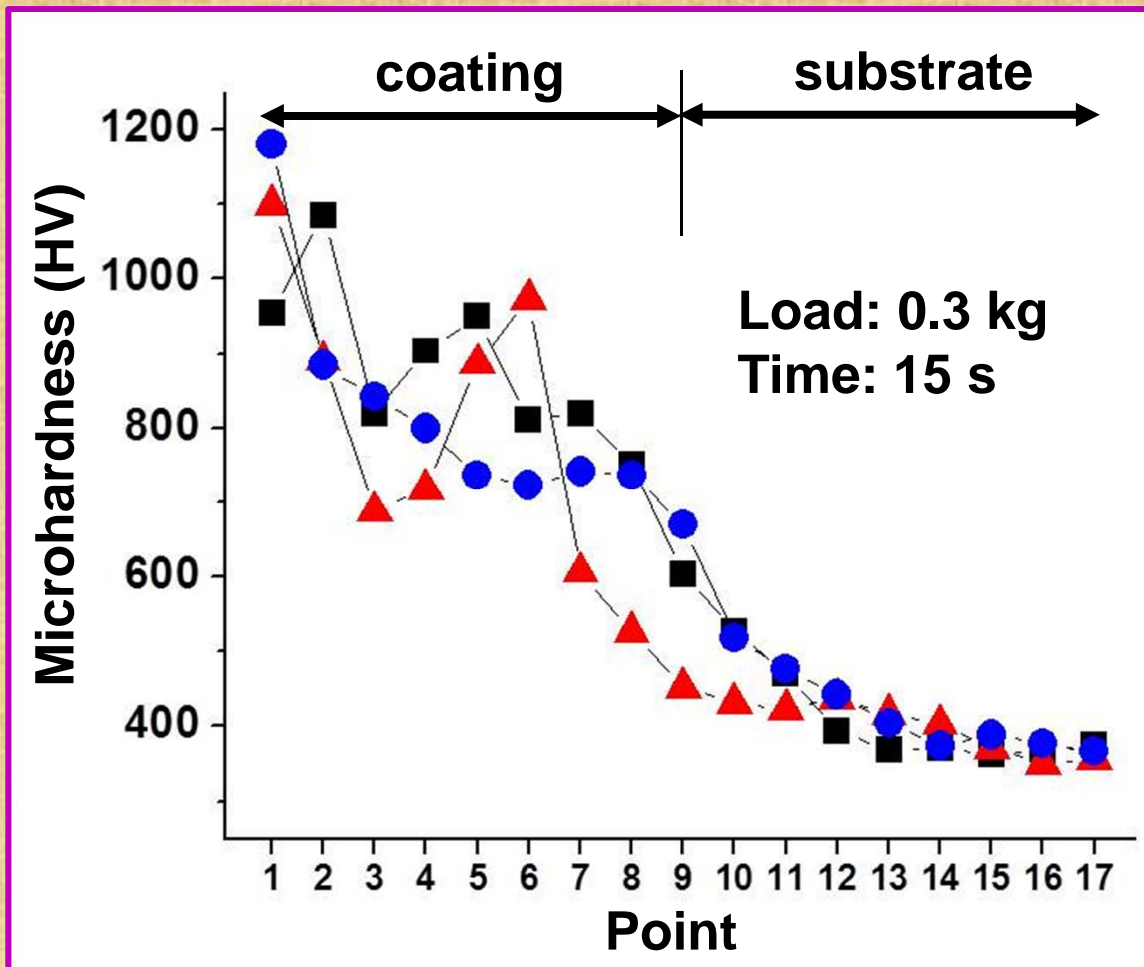


- High thickness, 400 microns
- Excellent bonding
- High hardness
- No cracks
- Relatively uniform



# Laser nitriding of Ti-6Al-4V

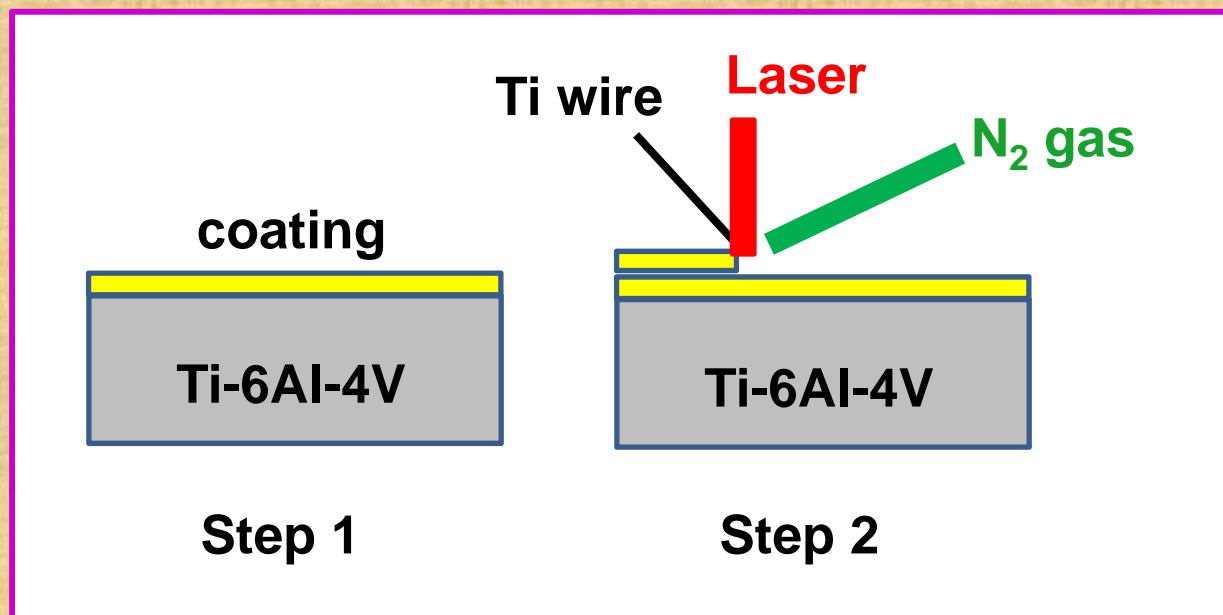
\* **Results** Measured 3 times at 3 different positions of 1 sample



# Laser nitriding of Ti-6Al-4V

## \* Future works

- Water erosion tests for laser nitrided samples.
- Processing parameters are reliable
  - Further improvement
  - Increase thickness up to 0.8~1 mm
  - Welding + Nitriding





# Laser surface remelting

## \* Objective

Surface remelting & rapid cooling  
→ microstructural change

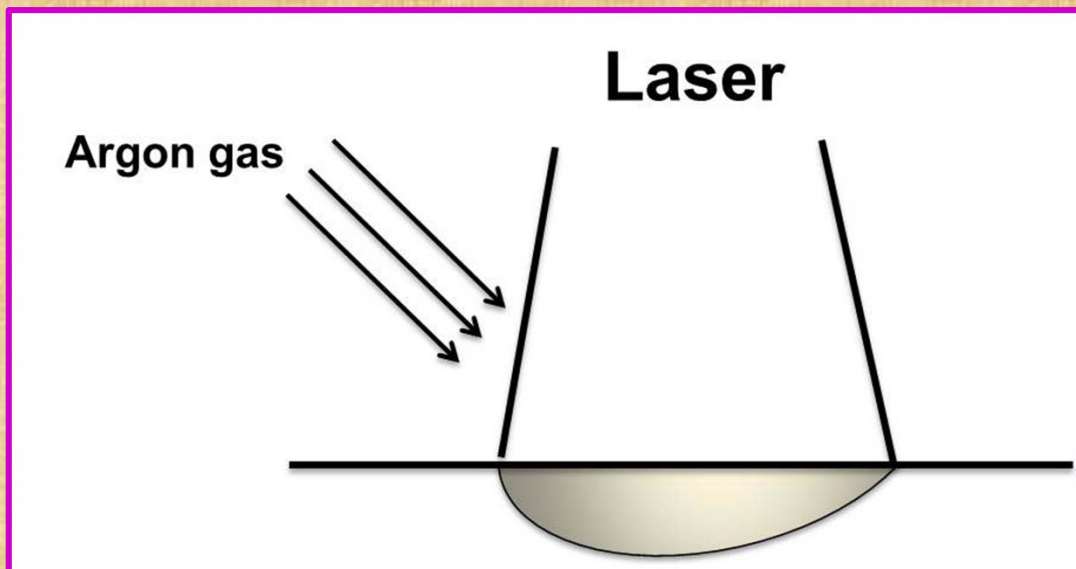
## \* Application

Papers (2008, 2010) of B. S. Mann:

- Cylindrical shaped samples
- Compressed air

→ New approach: Ar gas

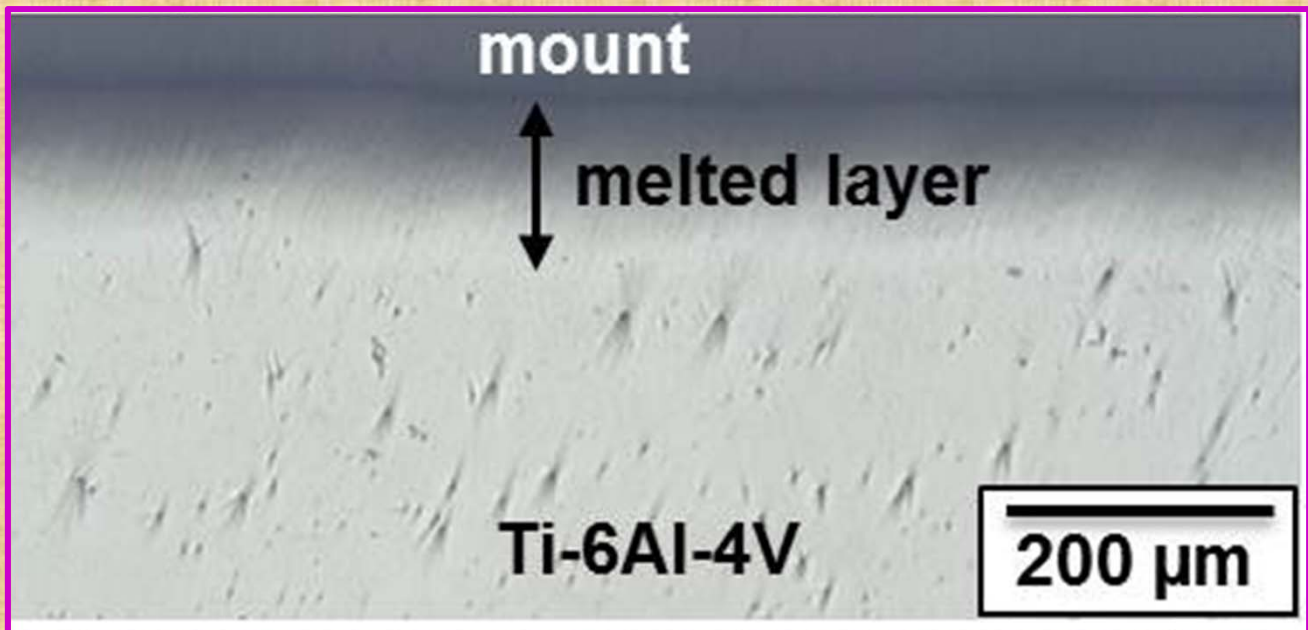
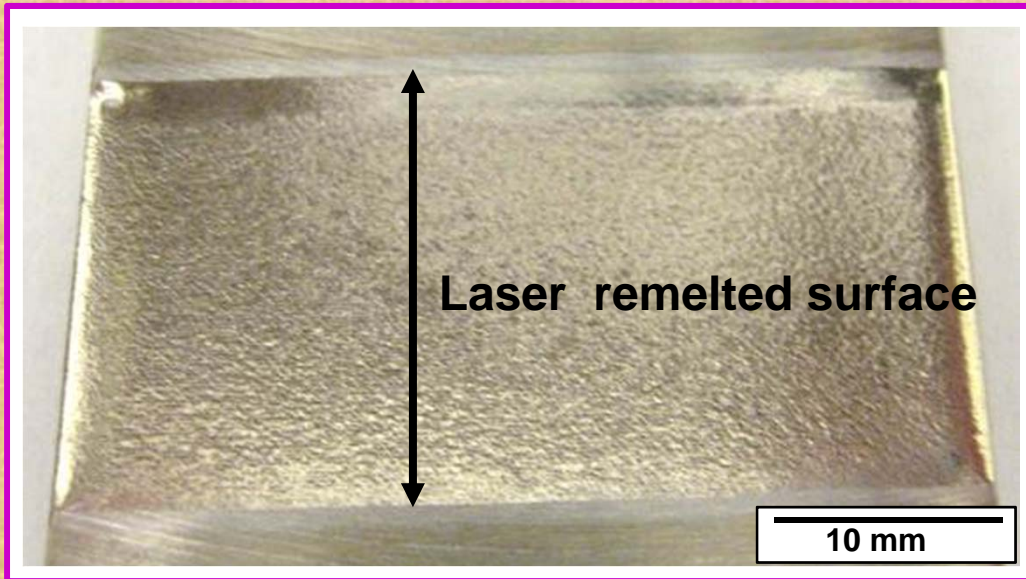
## \* Method





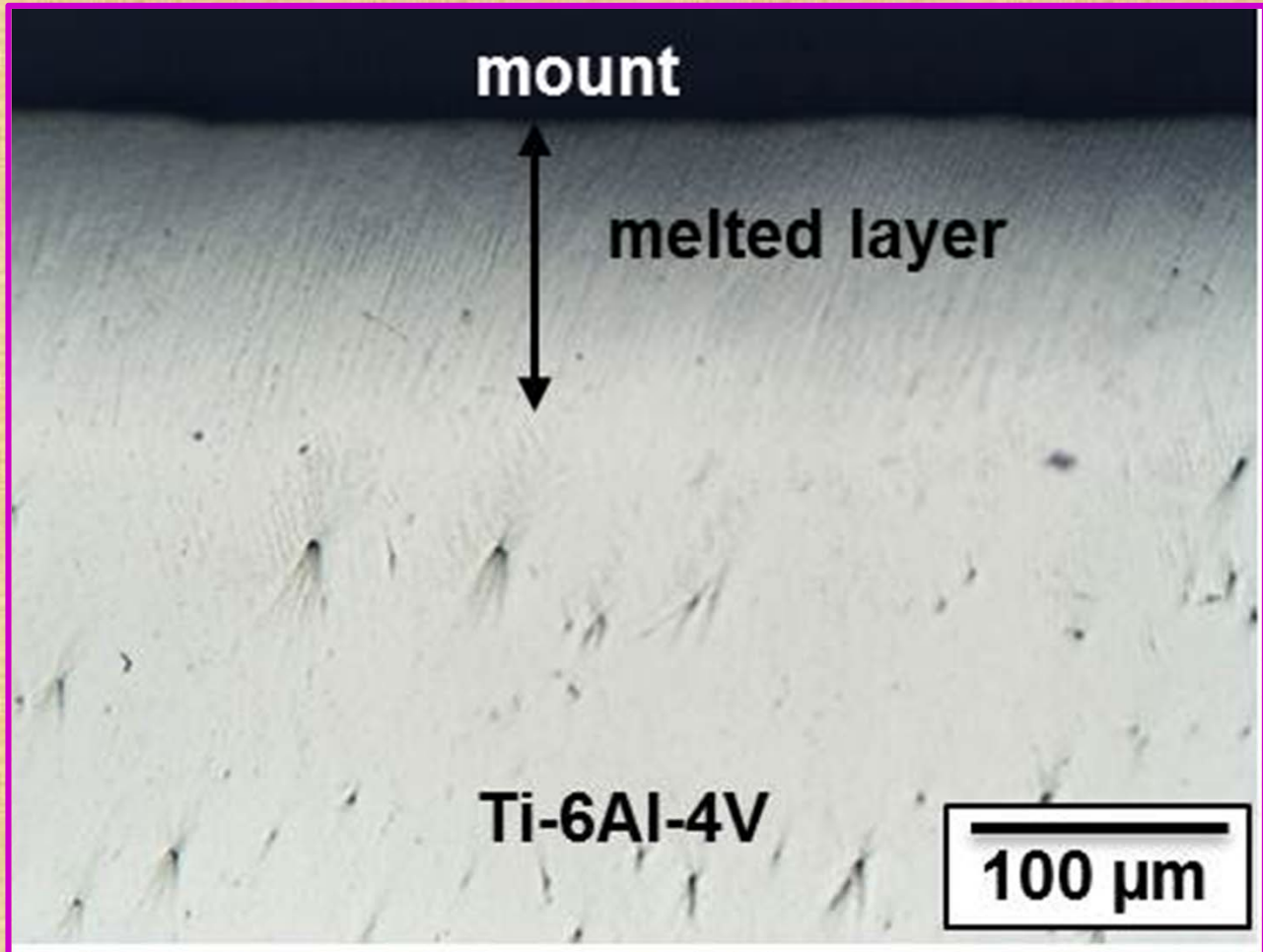
# Laser surface remelting

## \* Results



# Laser surface remelting

## \* Results



- Thickness: 100 microns
- Hardness unchanged
- No cracks
- Relatively uniform



## Laser surface remelting

### \* Future works

- Do etching → microstructure.

Etchant (**HF**,  $\text{HNO}_3$ ,  $\text{H}_2\text{O}$ )



**Safety training course required**

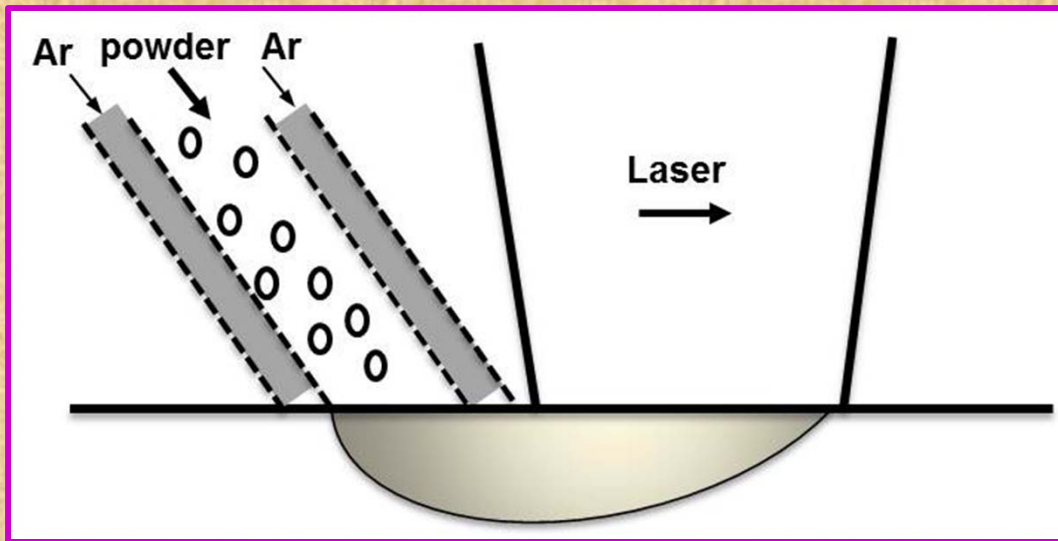
- Fabricate some samples for erosion tests



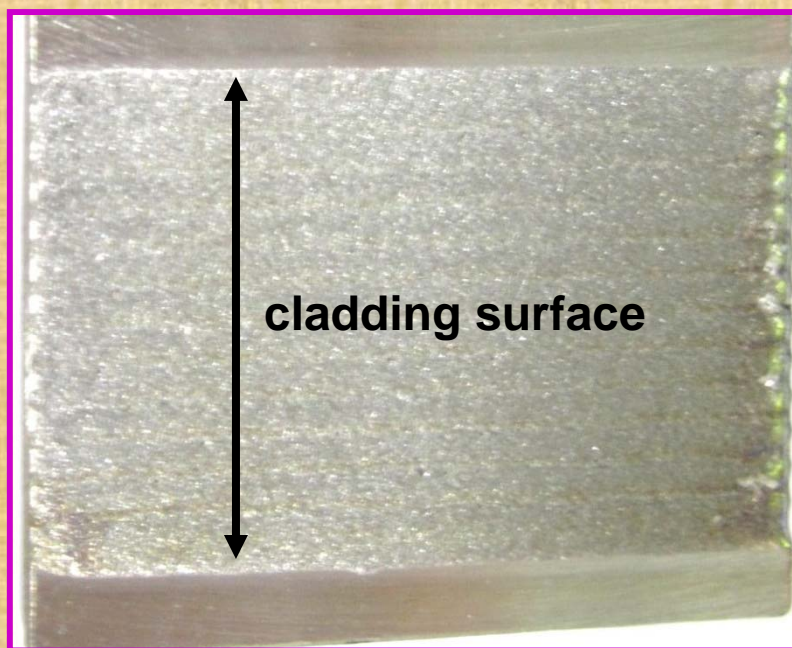
# Laser cladding

## \* Method

Inject  $\text{Al}_2\text{O}_3$  (60 microns) powder directly onto the surface



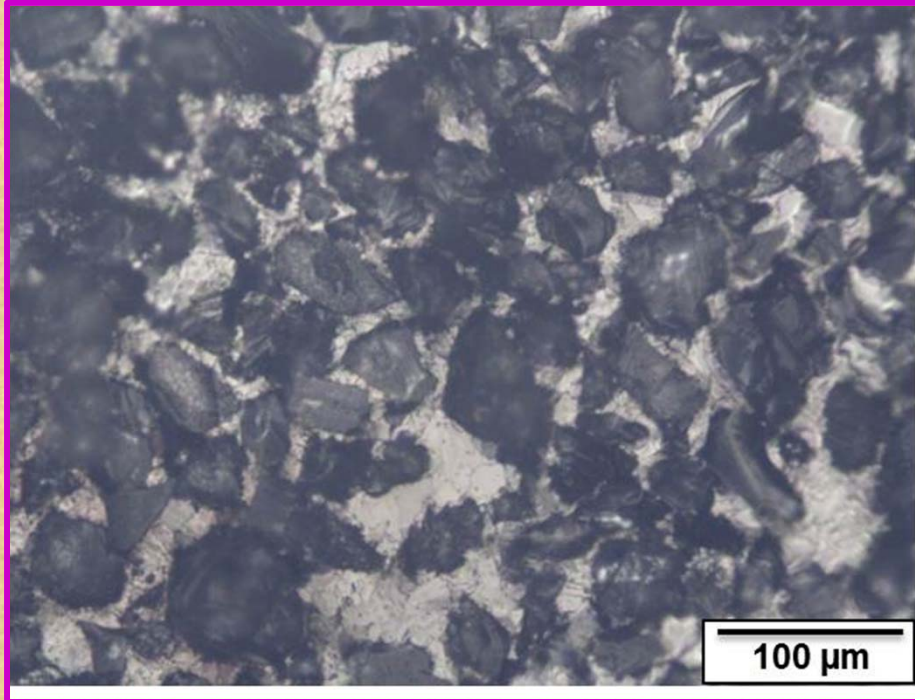
## \* Results



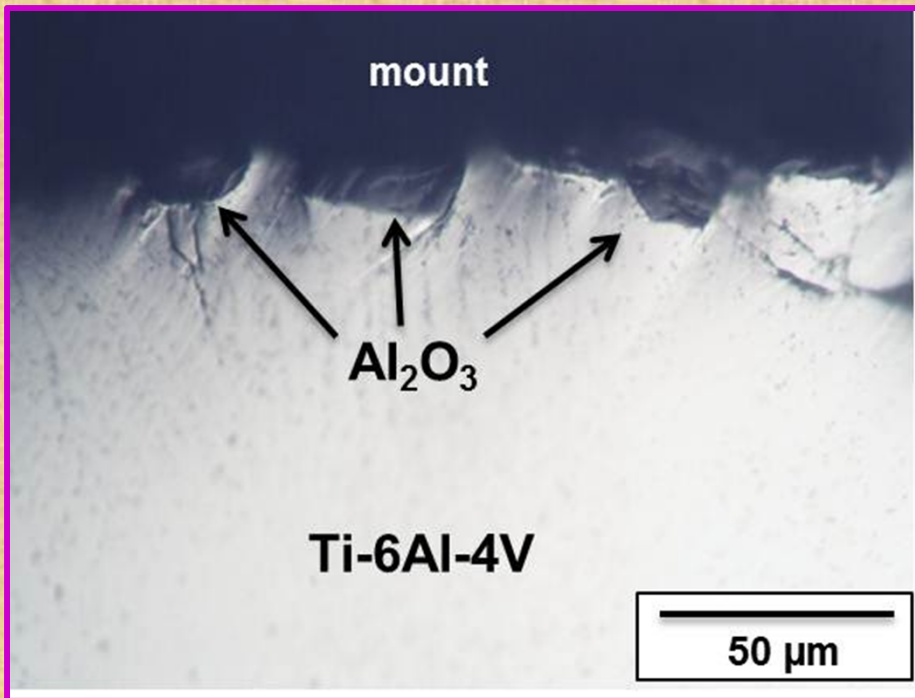


# Laser cladding

## \* Results



Top view



Cross section



# Laser cladding

## \* Results

### Defects

- Cracks, pores
- Low penetration depth of  $\text{Al}_2\text{O}_3$  particles

### Causes

- Different thermal expansions
- Processing parameters
- Equipment

## \* Future works

- Review the cladding process
- Solve technical issues



**Thank you for your time**