

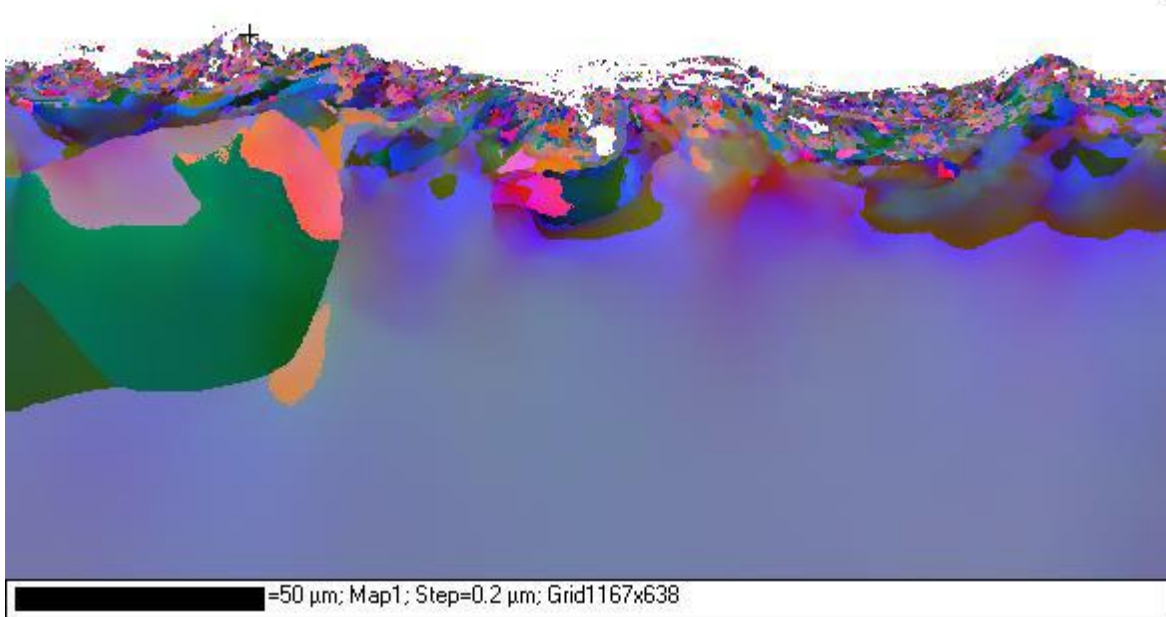
May, 2016 HTPCM2016, Les Embiez

Introduction :

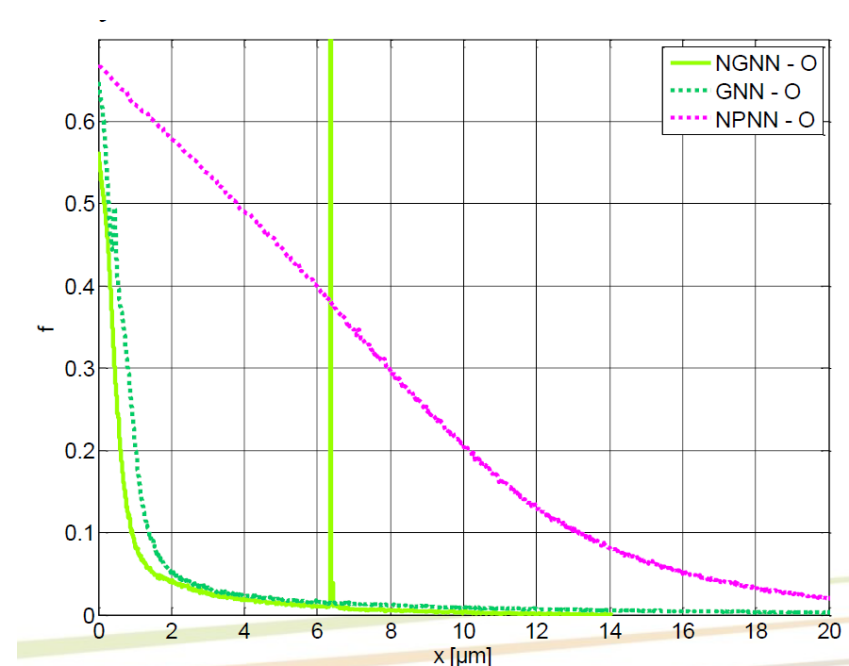
Improvement of nitrogen transport in surface nanocrystallized (NanoPeening[®]) during thermochemical treatments (gaseous nitridation) [1] :

- increase the nitrided depth
- decrease the nitriding temperature
- increase in hardness and resistance to wear [2-3]

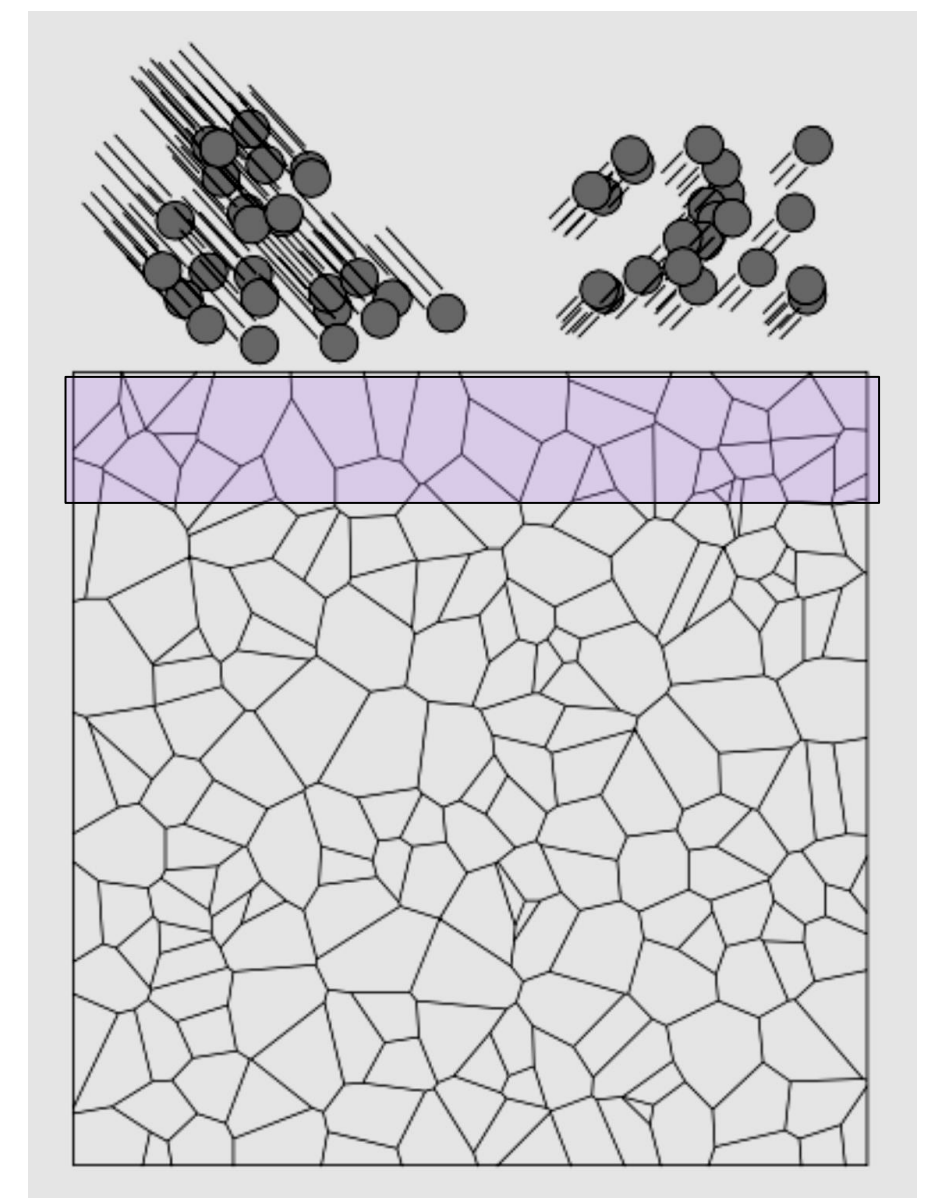
Samples : Pure Iron



EBSD after NanoPeening[®]



Oxygen depth profiles (GDOES)

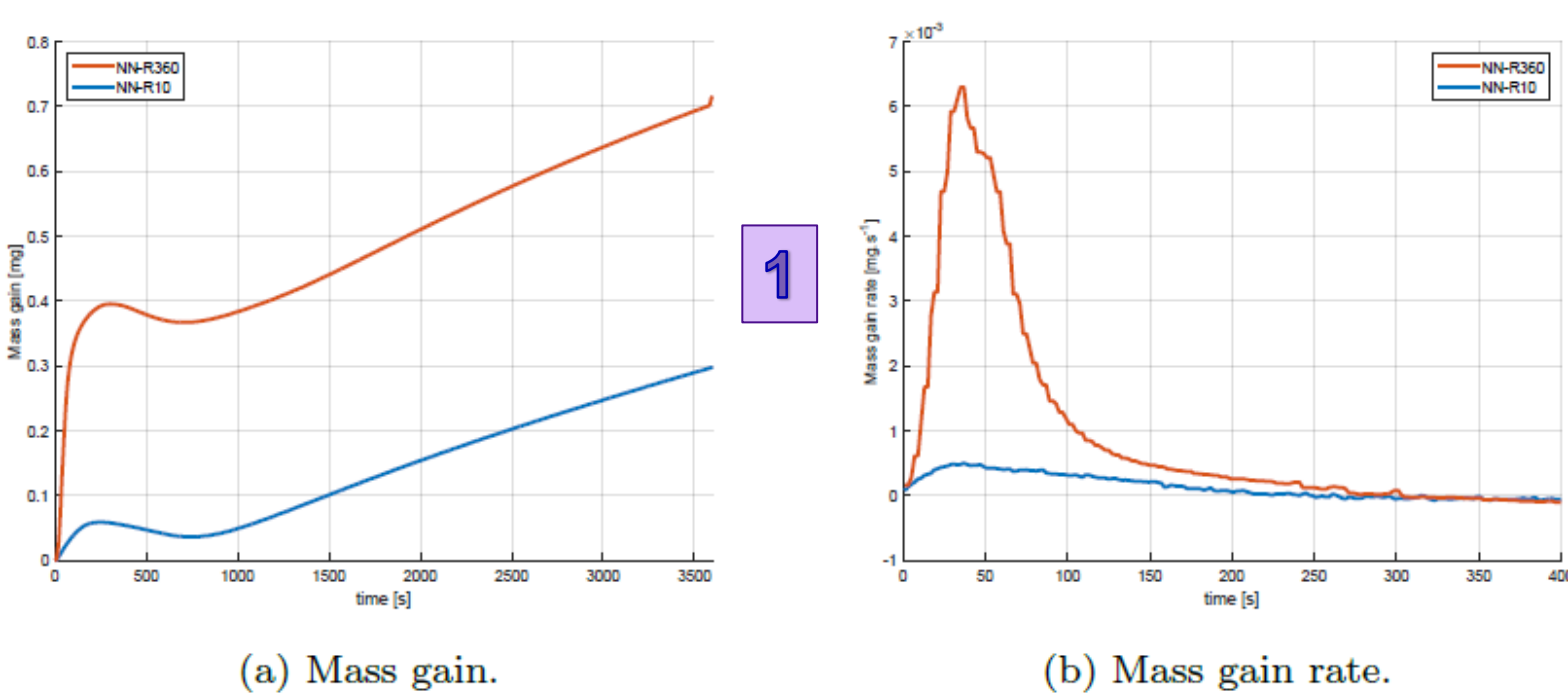


NanoPeening[®] : adaptation of shot peening
 → severe plastic deformations (10-20 min)

Nitriding kinetic studies

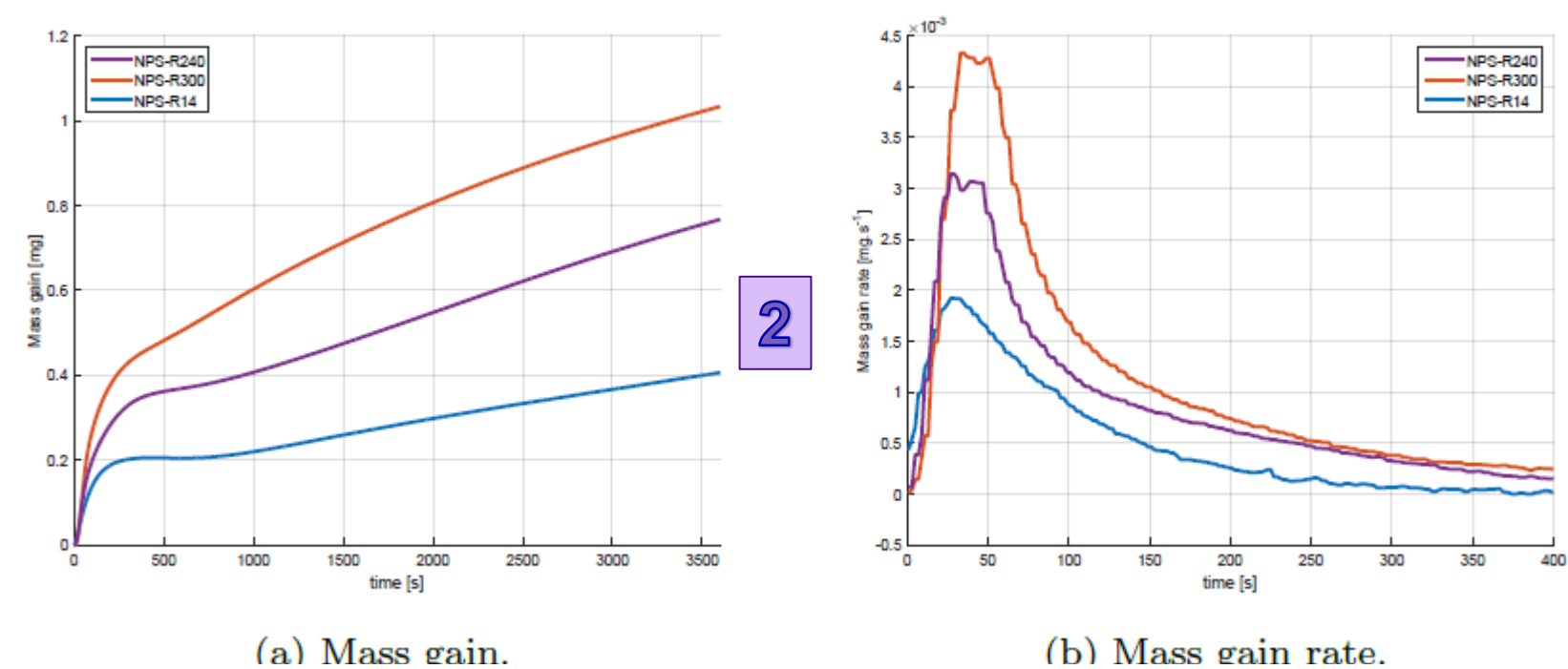
Symmetric thermobalance (SETARAM TAG-24)

- Rising to the soaking temperature 500° C at 30° C/min (He : 3 L/h).
- Isothermal reduction step (He : 3.875 L/h, H₂ : 0.125 L/h)
- Isothermal nitriding step (He : 2 L/h, N₂ : 1.4 L/h, NH₃ : 0.6 L/h) with different durations (from 60 to 210 minutes).
- Cooling at 30° C/min He (3 L/h).



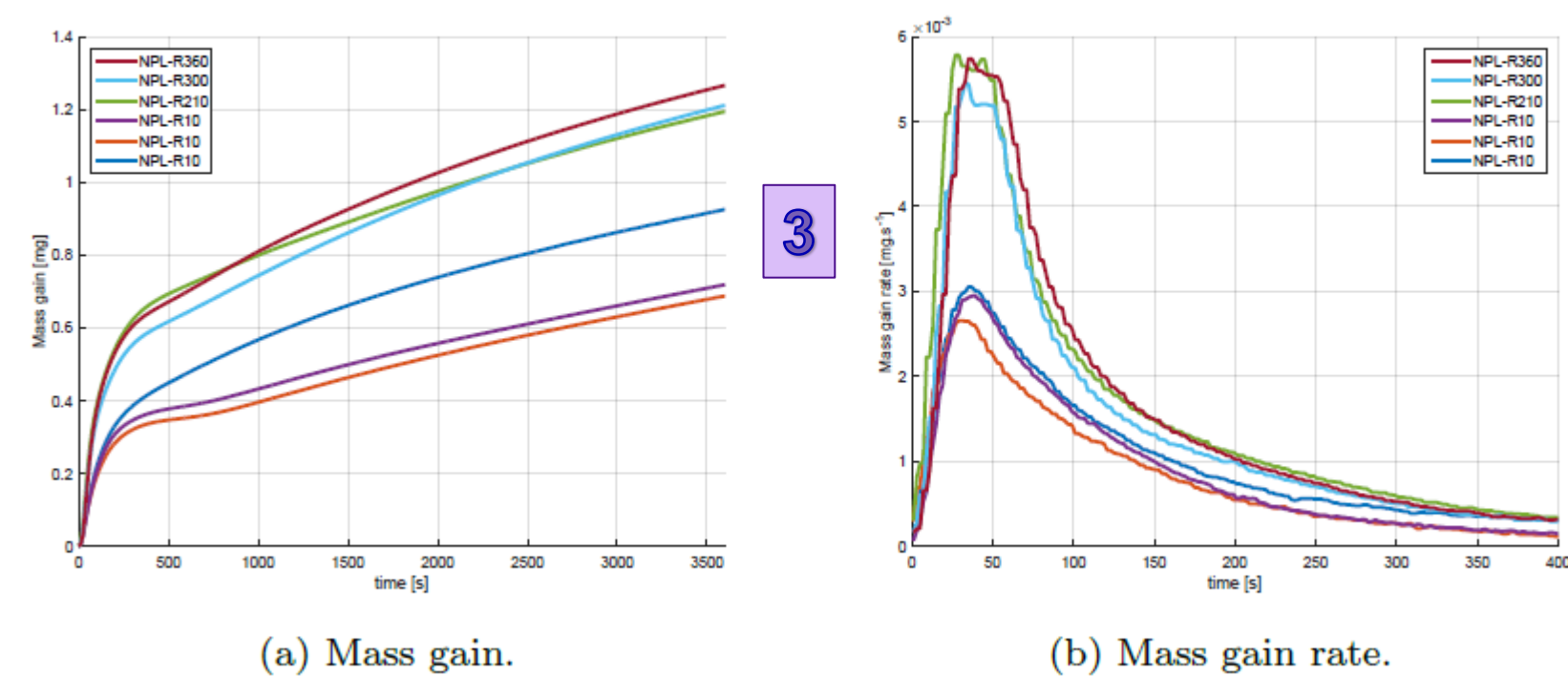
(a) Mass gain.

(b) Mass gain rate.



(a) Mass gain.

(b) Mass gain rate.



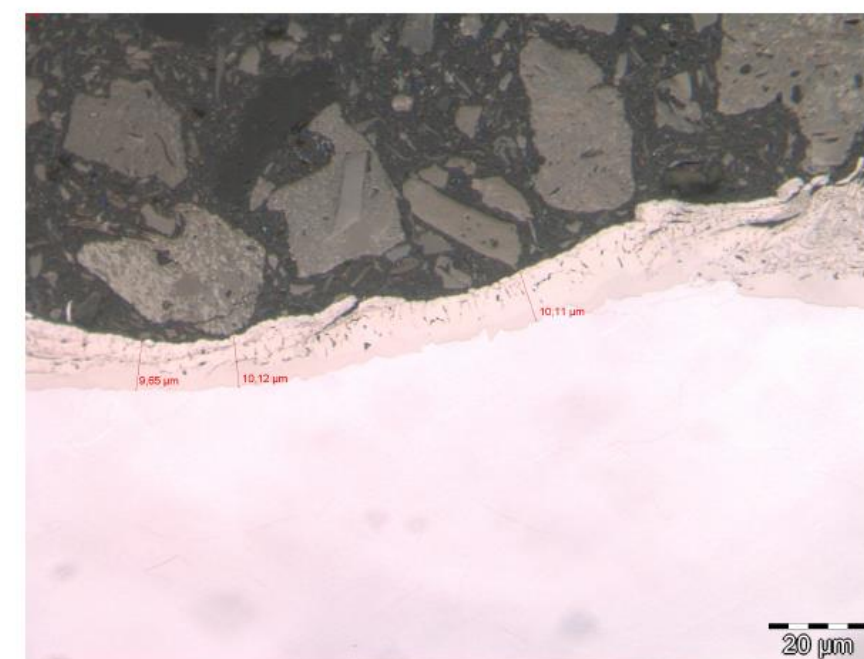
(a) Mass gain.

(b) Mass gain rate.

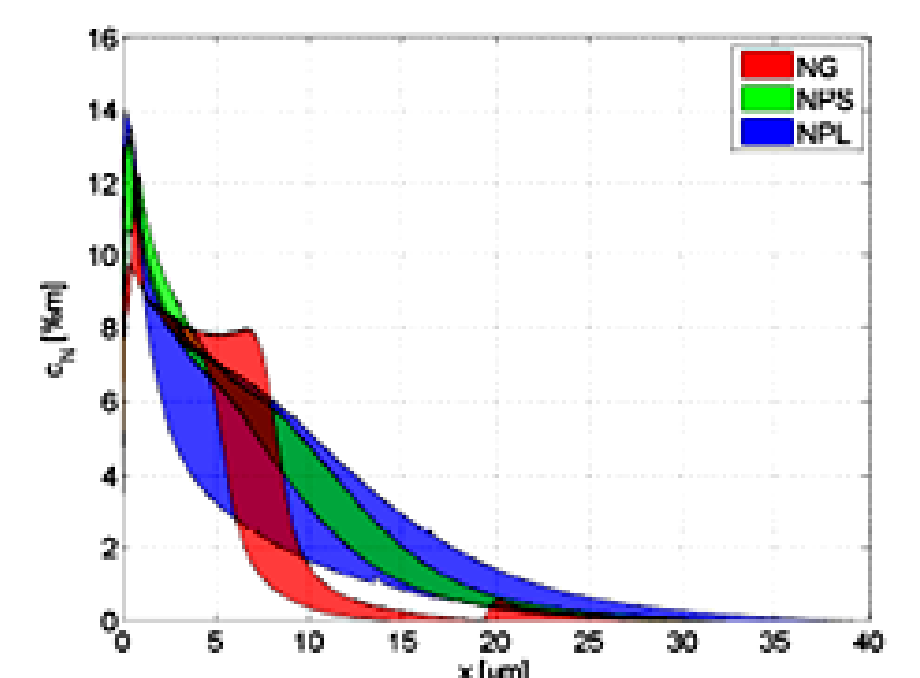
Mass gain and rate of mass gain for 1) untreated samples
 2) short duration nanostructured 3) long duration nanostructured samples

CONCLUSIONS

- NanoPeening[®] improve nitrogen diffusion
 → multiplying the number of grain boundaries which act as fast broadcast channels.
- Reduction improve nitriding efficiency
 → increasing the specific reacting area
- Transfer the process on materials with alloying elements.



Optical micrograph of a long duration nanostructured sample after nitriding



Nitrogen depth profiles (GDOES)

