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# NPOEM : Nanopatterns imprinted on POLymers for ElectroMagnetism



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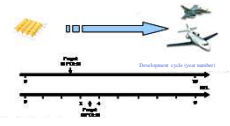


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## Introduction

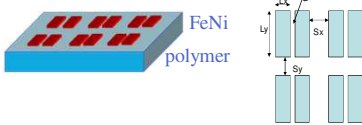


- N-POEM : funded by ANR 2010-2014 / industrial exploratory project / 6 partners
- Objectives: conception, realization and characterization of periodic nanostructures for 3 electromagnetic applications : microwave absorbers, optical filters, antireflective surfaces
- Applications in aeronautics
- Nanoimprint on flexible polymers

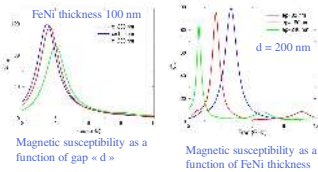


N-POEM = TRL-3-4

### Simulation

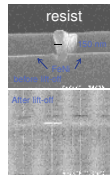
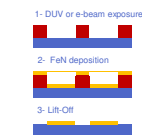


- Absorbance controllable from 0,8 GHz to 5 GHz
- Based on dipolar coupling between adjacent bands
- Control resonance frequency by adjustment of FeNi thickness and/or gap « d » between two adjacent bands



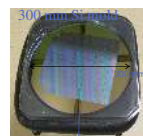
## Microwave absorber

### On silicon

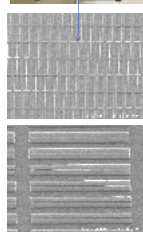
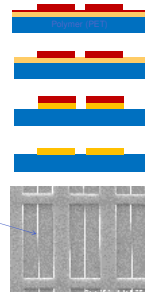


### Fabrication

#### On large scale PET

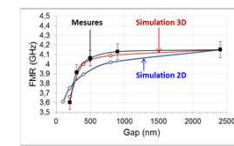
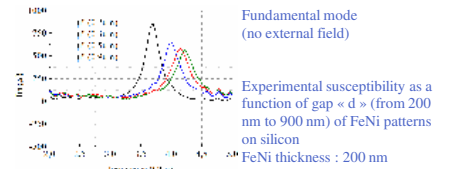


#### 1- Nanoimprint on FeNi



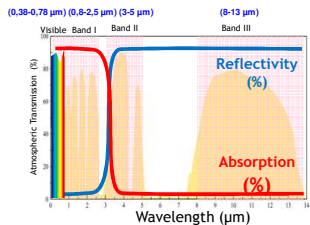
After imprint on PET

## Magnetic Characterization



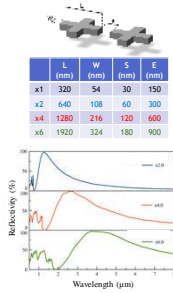
Good agreement between experimental results and simulation

## Optical filter



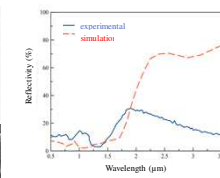
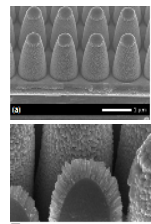
3 designs have been studied

### Ag crosses



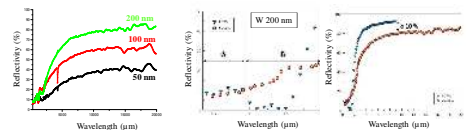
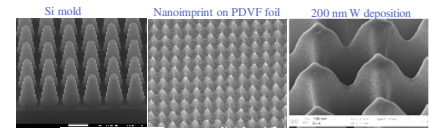
Simulation results demonstrate that Ag crosses are not adequate to achieve high reflectivity in band III.

### W cones



Difference between experimental results and simulation due to colorar deposition which induces some diffusion and light trapping in bands II and III  
W cones are not adapted to specifications

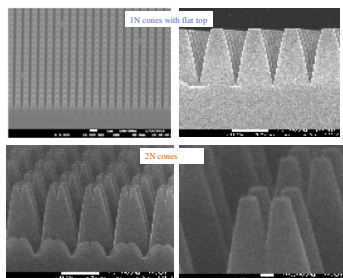
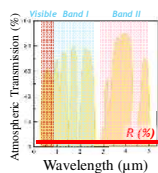
### W «egg box»



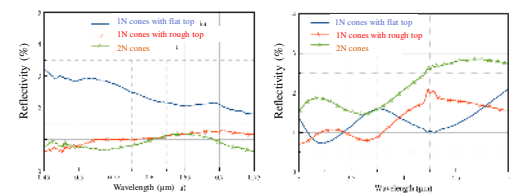
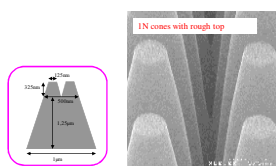
Comparison between experimental results (red) and simulation (blue) : good agreement with specifications; deviation of 10% in band III due to non flat top surfaces

## Antireflective surface

Objective: reflective coefficient lower than 2% between 0,4μm and 5μm on Si



Fabrication by E-beam lithography and specific plasma etching processes



Optical results : Good agreement with simulation and specification

## Conclusion

- 3 demonstrators realized and characterized, corresponding to 3 functionalities
- Good agreement with specifications and simulation
- Perspectives : increase TRL level and evaluate defect impact and aging of the patterns on functionalities for industrial applications

## References

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