



N-POEM: Nanostructures imprinted on polymers and Si for electromagnetic applications

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C. Gourgon, A. Ferchichi, M. Panabière, E. Grinenval, O. Desplats, et al.. N-POEM: Nanostructures imprinted on polymers and Si for electromagnetic applications. Micro- and Nano-Engineering conference- MNE 2014, 2014, Lausanne, Switzerland. hal-01798495

HAL Id: hal-01798495

<https://hal.science/hal-01798495>

Submitted on 8 Nov 2022

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NPOEM : Nanopatterns imprinted on POLymers for ElectroMagnetism



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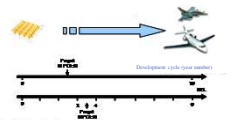
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Introduction

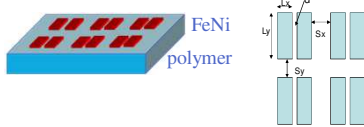


- N-POEM : funded by ANR 2010-2014 / industrial exploratory project / 6 partners
- Objectives: conception, realization and characterization of periodic nanostructures for 3 electromagnetic applications : microwave absorbers, optical filters, antireflective surfaces
- Applications in aeronautics
- Nanoimprint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

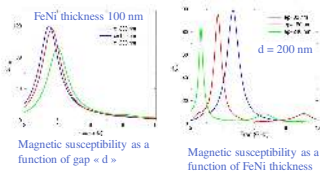


N-POEM = TRL 3-4

Simulation



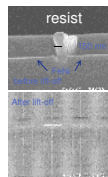
- Absorbance controllable from 0,8 GHz to 5 GHz
- Based on dipolar coupling between adjacent bands
- Control resonance frequency by adjustment of FeNi thickness and/or gap « d » between two adjacent bands



Microwave absorber

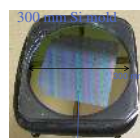
On silicon

- 1- DUV or e-beam exposure
- 2- FeNi deposition
- 3- Lift Off



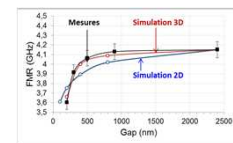
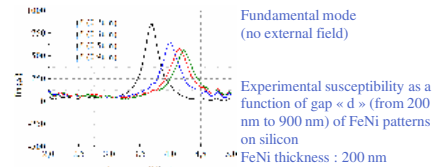
Fabrication

On large scale PET

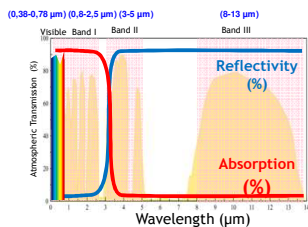


After imprint on PET

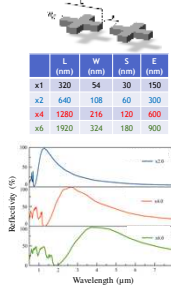
Magnetic Characterization



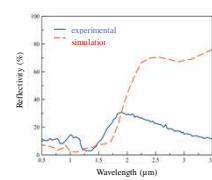
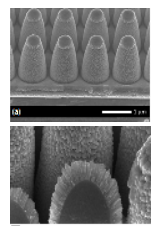
Optical filter



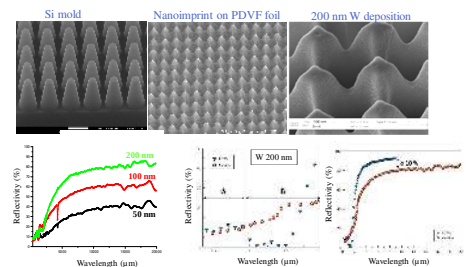
Ag crosses



W cones

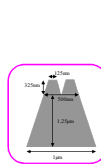
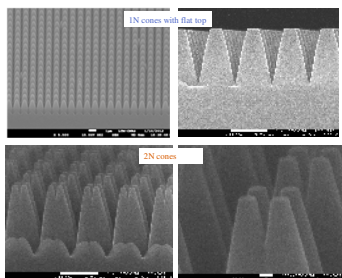
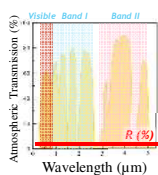


W «egg box»

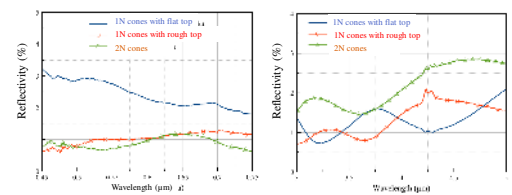


Antireflective surface

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



Fabrication by E-beam lithography and specific plasma etching processes



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

- [1] J.B. Brückner et al. Optics Express 21 (14) 2013 – p 16992-17006
- [2] J.B. Brückner et al. Applied Physics Letters 104 2014 p 081114
- [3] J.B. Brückner et al. Optics Express 21 (13) 2014 p 16043-16055