# Pierre LHUISSIER

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## Academic Position

Post-doctoral Researcher in the department of Materials Engineering of the University of Tokyo, Japan.

Doctor in Mechanics, Materials Sciences and Engineering of the Grenoble Institute of Technology, France.

"Agrégation" of Mechanics 2004 (French Government high level competitive examination for future teachers and researchers).

## Education

2006 - 2009	<b>Ph.D. in Mechanics, Materials Science and Engineering</b> , Grenoble Institute of Technology, France.
2005 - 2006	Master of Science in Mechanical Engineering and Materials (with honors), University
	Joseph Fourier, Grenoble, France.
2003 - 2004	"Agregation" of Mechanics.
2002 - 2003	Ecole Normale Superieure (ENS) of Cachan, France; Master of mechanical engi-
	neering (with honors).
2001 - 2002	Ecole Normale Superieure (ENS) of Cachan, France; Bachelor of mechanical engi-
	neering (with honors).
1998 - 2001	Post secondary Preparatory school in Physic and Engineering, Marseille, France.
1998	Scientific high school diploma, A-level (with honors).

# References

Yves BRECHET	Professor at Grenoble Institut of Technology (France), associated professor at Mc- Master University (Canada) and senior professor at the Universitary Institute of France. Researchs on materials at SIMaP (Grenoble, France). Member of scientific board at ArcelorMittal and CEA. Scientific advisor for Alcan, EDF and ONERA.
	yves.brechet@simap.grenoble-inp.fr
Luc SALVO	Associated Professor at Grenoble Institute of Technology (France). Research on
	materials at SIMaP (Grenoble, France).
	luc.salvo@simap.grenoble-inp.fr
Samuel FOREST	Professor at Mines-ParisTech (Paris, France). Researchs on viscoplasticity, ho- mogeneisation and continuum media behaviour at Centre des Matériaux (Evry, Evanac)
	rrance).
	samuel.torest@mat.ensmp.tr

Date of birth: December, 15th, 1980 Nationality French

#### <u>Ph.D.</u>

- **Title:** Random hollow spheres stackings : structure, behaviour and integration into sandwich structures.
- Supervisors: Y. Brechet (Professor, <u>yves.brechet@simap.grenoble-inp.fr</u>), L.Salvo (Assistant Professor, <u>luc.salvo@simap.grenoble-inp.fr</u>) and M.Fivel (CNRS researcher, marc.fivel@simap.grenoble-inp.fr).
- Keywords: Cellular material, Hollow spheres, Random stackings, X-ray tomography, Discret Element Method, Finite Element, Sandwich structures, Mechanical properties, mechanical tests, 3D image analysis.

**Summary:** The aim of this PhD was to characterize the mechanical behaviour of hollow spheres stackings, and to validate models describing their behaviour, in order to be able to predict the mechanical properties of structures with a hollow spheres foam core. The problem has been tackled, with increasing dimensional scales, with a combination of experiments, observations and modeling. The study is divided in 2 parts :

• Random hollow sphere stackings : The characterization of the material structure, thanks to image analysis techniques both in 2 dimensions and in 3 dimensions, gave the required information to model the contact law between two spheres. Then these laws have been implemented in a Discrete Element Code in order to model stackings. The mechanical behaviour of hollow spheres stackings has been studied for the main classes of loading (except shearing). Both Discrete Element Method models and analytical models have been calibrated to ensure a good description of the material behaviour. Within the same time, an investigation of the material with in situ X-ray tomography tests, allowed to understand the relation between the local deformation mechanisms and the macroscopic behaviour.

• Integration into sandwich structures : Sandwich structures with hollow sphere foam core have been loaded both in four-point bending and in indentation. The structures have been modeled both with Finite Elements and with analytical models. A large attention have been paid to the damaging modes, and on the structure response up to large strains.

#### **Research trainees**

- [3] Master training course at G.I.T. (SIMaP-GPM2) in Grenoble (France) under supervising of L. Salvo. Hollow spheres foam sandwich structures: behavior and optimization, Jan. to Jun. 2006. The modeling of the mechanical properties of sandwich structures with a metallic foam core have been performed thanks to various approaches. From constitutive laws obtained by simple mechanical tests, the performances of the structures have been estimated both with analytical models and with finite elements simulations. Models have been compared to 4-point bending tests performed on sandwich structures with a core made of aluminum foam. A particular attention have been paid to the structures with a thin core in relation to the faces thickness.
- [2] Practical at IRD (GreatIce) in Quito (Ecuador ) under supervising of E. Cadier. Climat study around Antizana Glacier, Dec. 2004 to Apr. 2005. Correlations between local pluviometric data and glaciar ablation data, and large scale meteorologic data have been studied. Principal component analysis were used to set up a quantitative model of Antizana glaciar mass balance based on local pluviometric events and Niño3+4 index.
- Training course at NTNU (SIMLab) in Trondheim (Norway) under supervising of M. Langseth and A. H. Clausen. Influence of an heating system on Split-Hopkinson Tension Bar tests measures, Apr. to Jul. 2003.

Various tests at high temperature have been performed on instrumented samples on a Split-Hopkinson Tension Bar. Tests have also been simulated with Finite Elements models. Both methods gave an estimation of the influence of the heating system on tests measurements. Limitations and possible improvements of the heating system have been suggested.

#### Internationals journals and conferences

- [4] Study of thin sandwich beams with steel faces and perforated polypropylene core in bending loading : experiments and simulations, P. Lhuissier, J.-P. Masse, L. Salvo, Y. Brechet, (submittion in process).
- [3] Quasistatic mechanical behaviour of stainless steel hollow sphere foam: macroscopic properties and damage mechanisms followed by X-ray tomography, P. Lhuissier, A. Fallet, L. Salvo, Y. Brechet, Mater. Letters, 63, num. 13-14, 2009.
- [2] Mechanical behaviour of metallic Hollow Spheres Foam, A. Fallet, P. Lhuissier, L. Salvo, Y. Brechet, Adv. Eng. Mater., 10, num. 9, 2008.
- Variations of a low latitude Andean glacier according to global and local climate variations: first results, E. Cadier, M. Villacis, A. Garcés, P. Lhuissier, L. Maishincho, R. Laval, D. Paredes, B. Caceres & B. Francou, *Glacier Hydrology, IAHS Publ.* 318, 2007.

#### **Conference** proceedings

- [3] Stainless steel hollow spheres foams behaviour under uniaxial tensile loading, P. Lhuissier, L. Salvo & Y. Brechet, Porous Metals and Metallic Foams : MetFoam 2009
- [2] Metallic Sandwich Structures with Hollow Sphere Foam Core, P. Lhuissier, A. Fallet, L. Salvo, Y. Brechet, M.Fivel, MRS Symposium Proceedings Series vol. 1188, Architectured Multifunctional Materials, Spring Meeting 2009
- Constitutive Equation for the Compression of Hollow Spheres Foam, P. Lhuissier, M.Fivel, L. Salvo & Y. Brechet, Porous Metals and Metallic Foams : MetFoam 2007

#### **Oral presentations**

Sep. 2009	Stainless steel hollow spheres foams behaviour under uniaxial tensile loading, P. Lhuissier,
	L. Salvo & Y. Brechet, Porous Metals and Metallic Foams : MetFoam 2009, Bratislava,
	Slovaquie.
Avril 2009	Metallic Sandwich Structures with Hollow Sphere Foam Core, MRS Spring Meeting 2009,
	Symposium LL : Architectured Multifunctional Materials, San Francisco, Californie, USA.
Nov. 2007	4-points bending tests on perforated polymer core sandwich, P. Lhuissier, JP. Masse, Ar-
	chitectured Materials Workshop, University of Cambridge, Angleterre.
Oct. 2008	Hollow spheres foams : properties and integration in sandwich structures, P. Lhuissier,
	ArcelorMittal Multimaterial Workshop, Lyon.
Jan. 2008	Constitutive equation of the behavior of hollow sphere foams under compressive loading,
	P. Lhuissier, M. Fivel, Y. brechet, L. Salvo, MAPO project (POrous and microporous
	structural Materials for multifonctionnal applications), ONERA, Chatillon.
Sep. 2007	Constitutive equation for the compression of metallic hollow spheres foam, MetFoam 2007
	5th International Conference on Porous Metals and Metallic Foams, Montréal, Canada
Juil.2007	Characterization of the behavior of stainless steel hollow spheres stacking, P. Lhuissier, A.
	Fallet, MecaMat Workshop, Saint-Etiennes.
Sep. 2007	Constitutive equation for the compression of metallic hollow spheres foam, MetFoam 2007
	5th International Conference on Porous Metals and Metallic Foams, Montréal, Canada
Avril 2007	Mechanical characterization of foams by hollow spheres packing, HetMat meeting, Univer-
	sité Catholique de Louvain (UCL), Louvain La Neuve, Belgique

#### Poster presentations

- Sep. 2008 Quantification of the damaging of stainless steel hollow spheres foams by X-ray tomography analysis, 3D-IMS08 1st Conference on 3D-Imaging of Materials and Systems, Bordeaux, France
- Aug. 2007 Empilements aléatoires de sphères creuse d'acier: comportement et modélisation, CFM07 18th Congrés Français de Mécanique, Grenoble, France

# **Teaching Experience**

2006-2009 **Teaching Assistant** at Grenoble Institute of Technology (Master first year). Approximately 64h of courses per year:

- Tutorial in **materials selection** : identification of specifications, methods of selections, application to industrial case
- Tutorial in **programming methods** : programming, numerical integration and derivation, Finite Element Method
- Lecture Courses in mechanical engineering : design in mechanics, technology
- Lecture Courses in **fluid mechanics**
- Practical works in **initiation to materials sciences** : granular materials, structures, recrystallization, thermal treatments...
- Practical works in **microstructure**
- 2005-2006 Tutorial in thermal machines in University Institute of Technology of Thermal Engineering (30h).

## **Technical Skills**

#### Experimental

**Elaboration** : Machining of experimental supports and samples : work machine, metal spinning, wire electro-erosion ...

**Structural characterization** : X-ray tomography and 3D images analysis, in situ tests, microscopy. **Mechanical characterization** : Compression and tension tests and 2D images analysis, tri-axial tests, bending tests.

#### **Computer Sciences**

Image analysis : ImageJ, Avizo.
Numerical simulations : ZeBuLoN (Finite Elements, ONERA-Mines of Paris), DP3D (discret elements method, C.Martin-SIMaP-GrenobleINP)
Languages : C, C++, Java, Fortran90
Miscelanious : LateX, Gnuplot, Solid Edge (CAO), Catia (CAO)...

#### Languages

French (mother tongue), English (fluent), Spanish (operational), Japanese (basic skills).

# Experiences

- French teacher for spanish native speakers in Ecuador (2005).
- Leader member of the mountain club at ENS Cachan (2002-2003).
- Member of the art club at ENS Cachan (2002-2003).
- One year discovery travel in South America and north of India.
- Ski monitor for children at Ski Club Dignois (1998).
- Judo temporary professor at Grenoble Judo 38 (2006-2007).

### Miscellaneous

- Sport: Judo, sailing (sport and cruising), climbing, skiing, trekking...
- Hobbies: Reading, travels, cooking.