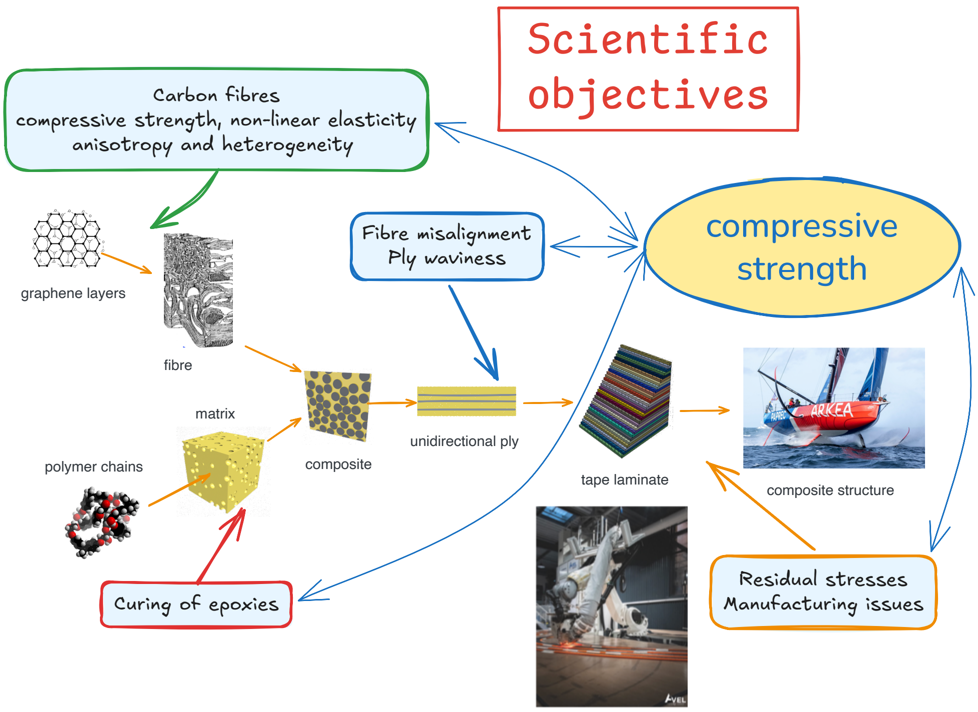
Postdoctoral Position in Advanced Composite Materials

- **Location:** Université Bretagne Sud, Lorient, France
- **Supervisors:** Prof. Vincent Keryvin, Dr. Cédric Bernard
- **Start date:** 1 December 2026
- **Duration:** 24 months
- **Net salary:** €2,600/month
- **Contact:** vincent.keryvin@univ-ubs.fr, cedric.bernard@univ-ubs.fr
- **Application deadline**: 15 September, 2026
- **Send CV to contact persons by e-mail**

Eligibility Criteria

- Researchers who have spent at least 18 months abroad (not in France) between 1 May 2022 and the project start date.
- PhD in Materials Science, Mechanical Engineering, or a related field.



Characterisation and Modelling of the Mechanical Behaviour of Thick Composite Structures for Maritime Transport: Role of Resin Curing, Environmental Conditions, and Carbon Fibres

This project aims to improve the understanding and control of the mechanisms leading to longitudinal compressive failure in carbon-fibre composites, with particular emphasis on fibre and ply waviness generated during the curing of polymer resins. These misalignments, often invisible to the naked eye, can significantly affect mechanical properties, especially longitudinal compressive strength, durability, and the overall performance of composite structures used in competitive sailing and maritime transport.

By improving the control and prediction of these microscopic defects, the project will contribute to enhanced material quality, reduced manufacturing waste, and increased service life of composite components.

The project is aligned with Brittany's strategic innovation domain, "Ship of the Future". It contributes to the maritime energy transition through the development of lighter structures with reduced environmental impact, thereby supporting the decarbonisation of the maritime sector. It also addresses broader sustainability challenges by reducing production waste and preparing the transition towards recyclable thermoplastic composite materials.

From a scientific perspective, the project combines experimental, numerical, and advanced computational approaches:

- **Quantitative measurement of fibre misalignments:** development of automated image-processing and deep-learning tools to detect, quantify, and characterise fibre waviness and orientation in composite materials.
- **Multiphysics modelling of resin curing:** development of thermo-chemo-mechanical models incorporating epoxy cure kinetics, viscoelastic deformation, residual stress development, and the formation of microscopic defects, enabling the prediction of fibre misalignment during curing.
- **3D microstructure reconstruction and generation:** use of experimental observations to reconstruct and generate representative misaligned microstructures for advanced numerical analyses of mechanical behaviour, particularly compressive strength.
- **Characterisation of constituent contributions to compressive failure:** investigation of the influence of temperature and moisture uptake on resin softening, together with the role of carbon-fibre properties, including compressive strength, non-linear elasticity, anisotropy, and material heterogeneity.

These activities will benefit from collaborations between Université Bretagne Sud, industrial partners from the competitive sailing sector, and companies specialising in automated composite manufacturing through Automated Fibre Placement (AFP) and Automated Tape Laying (ATL). These partnerships will enable the validation of the developed models on industrial-scale structures such as masts and hydrofoils.

References of the research team

Baley, C., Davies, P., Troalen, W., Chamley, A., Dinham-Price, I., Marchandise, A., & Keryvin, V. (2024). Sustainable polymer composite marine structures: Developments and challenges. Progress in Materials Science, 145, 101307. https://doi.org/10.1016/j.pmatsci.2024.101307

Grabow, M., Keryvin, V., Marchandise, A., Grandidier, J.-C., Baley, C., Guennec, C. L., & Fagherazzi, O. (2022). Influence of the manufacturing process on the interlaminar tensile strength of thick unidirectional continuous epoxy/carbon fibre composites. Composites Part A: Applied Science and Manufacturing, 154, 106754. https://doi.org/10.1016/j.compositesa.2021.106754

Guruprasad, T. S., Keryvin, V., Charleux, L., Guin, J.-P., & Arnould, O. (2021). On the determination of the elastic constants of carbon fibres by nanoindentation tests. Carbon, 173, 572–586. https://doi.org/10.1016/j.carbon.2020.09.052

Guruprasad, T. S., Keryvin, V., Kermouche, G., Marthouret, Y., & Sao-Joao, S. (2023). Compressive behaviour of carbon fibres micropillars by in situ SEM nanocompression. Composites Part A: Applied Science and Manufacturing, 173, 107699. https://doi.org/10.1016/j.compositesa.2023.107699

Keryvin, V., Kermouche, G., & Sao-Joao, S. (2026). Radial elastic heterogeneity in a high-modulus carbon fibre assessed by nano-indentation and micro-pillar compression. Carbon, 247, 120991. https://doi.org/10.1016/j.carbon.2025.120991

Keryvin, V., Marchandise, A., & Grandidier, J.-C. (2022). Non-linear elastic longitudinal behaviour of continuous carbon fibres/epoxy matrix composite laminae: Material or geometrical feature? Composites Part B: Engineering, 247, 110329. https://doi.org/10.1016/j.compositesb.2022.110329

Keryvin, V., Marchandise, A., Mechin, P.-Y., & Grandidier, J.-C. (2020). Determination of the longitudinal non linear elastic behaviour and compressive strength of a CFRP ply by bending tests on laminates. Composites Part B: Engineering, 187, 107863. https://doi.org/10.1016/j.compositesb.2020.107863

Keryvin, V., Mechin, P.-Y., Bendaoued, A., & Bernard, C. (2026). An experimental method for determining the in-plane shear modulus of carbon fibres. Composites Part B: Engineering, 309, 113037. https://doi.org/10.1016/j.compositesb.2025.113037

Keryvin, V., Méchin, P.-Y., Fabing, E., Pillin, I., Mahé-Flahaut, K., & Le Palabe, A. (2024). Counter-intuitive effect of the degree of cure of epoxy resins on the compressive strength of continuous fibre composites. Composites Part B: Engineering, 287, 111836. https://doi.org/10.1016/j.compositesb.2024.111836

Keryvin, V., Ueda, M., Kermouche, G., Marthouret, Y., & Sao-Joao, S. (2025). Assessing the validity of micro-pillar compression for determining strength and stiffness of carbon fibres. Composites Science and Technology, 272, 111362. https://doi.org/10.1016/j.compscitech.2025.111362

Launay, A., Keryvin, V., Grandidier, J.-C., Mechin, P.-Y., & Balze, R. (2022). Design of a set-up for measuring the residual compressive strength after high load and high cycle compression fatigue on CFRP. Composite Structures, 286, 115294. https://doi.org/10.1016/j.compstruct.2022.115294

Mechin, P.-Y., Borras, A., Cottard, K., & Keryvin, V. (2025). A unified method to generate representative volume elements with tailored random fibre arrangements to estimate the shear and transverse behaviours of unidirectional continuous fibres composite plies. Journal of Composite Materials, 59(6), 793–805. https://doi.org/10.1177/00219983241300144

Méchin, P.-Y., Borras, A., & Keryvin, V. (2024a). Influence of Microstructure Randomness on the Shear Behaviour and Compressive Strength of Continuous Carbon Fibre Composites. Applied Composite Materials, 31(4), 1173–1189. https://doi.org/10.1007/s10443-024-10230-3

Méchin, P.-Y., Borras, A., & Keryvin, V. (2024b). Influence of Microstructure Randomness on the Shear Behaviour and Compressive Strength of Continuous Carbon Fibre Composites. Applied Composite Materials. https://doi.org/10.1007/s10443-024-10230-3

Mechin, P.-Y., Grabow, M., Launay, A., Grandidier, J. C., Zhang, Z., & Keryvin, V. (2025). Estimation of compressive strength in thick continuous fibre composites: Quantifying the role of initial fibre misalignment. Composites Part A: Applied Science and Manufacturing, 196, 108950. https://doi.org/10.1016/j.compositesa.2025.108950

Méchin, P.-Y., Grabow, M., Launay, A., Grandidier, J. C., Zhang, Z., & Keryvin, V. (2025). Estimation of compressive strength in thick continuous fibre composites: Quantifying the role of initial fibre misalignment. Composites Part A: Applied Science and Manufacturing, 196, 108950. https://doi.org/10.1016/j.compositesa.2025.108950

Mechin, P.-Y., & Keryvin, V. (2023). Compressive strength estimation of continuous carbon fibre/epoxy resin composite by micro-mechanical numerical modelling. Composite Structures, 305, 116534. https://doi.org/10.1016/j.compstruct.2022.116534

Mechin, P.-Y., & Keryvin, V. (2024). Analysis on the Key Parameters Driving the Mast Stiffness Accuracy to Improve Sail Design using Fluid/Structure Simulation with Beam Elements. Journal of Sailing Technology, 9(01), 57–77. https://doi.org/10.5957/jst/2024.9.1.57

Mechin, P.-Y., Keryvin, V., & Grandidier, J.-C. (2020). Limitations on adding nano-fillers to increase the compressive strength of continuous fibre / epoxy matrix composites. Composites Science and Technology, 192, 108099. https://doi.org/10.1016/j.compscitech.2020.108099

Mechin, P.-Y., Keryvin, V., & Grandidier, J.-C. (2021). Effect of the nano-filler content on the compressive strength of continuous carbon fibre/epoxy matrix composites. Composites Part B: Engineering, 224, 109223. https://doi.org/10.1016/j.compositesb.2021.109223

Mechin, P.-Y., Keryvin, V., Grandidier, J.-C., & Glehen, D. (2019). An experimental protocol to measure the parameters affecting the compressive strength of CFRP with a fibre micro-buckling failure criterion. Composite Structures, 211, 154–162. https://doi.org/10.1016/j.compstruct.2018.12.026

Méchin, P.-Y., Savine, F., & Keryvin, V. (2026). On the use of relevant models and analyses for the structural mast design of America's Cup racing yachts (AC75). Journal of Ocean Engineering and Science, S2468013325000919. https://doi.org/10.1016/j.joes.2025.11.005