

Correlation Of Interfacial Changes During Seawater Exposure Of Adhesively Bonded Structures



NICOLAS BAUDIN
INTERNSHIPS IN FRANCE INITIATIVE

ENSTA Bretagne

Name of the hosting institution in France	ENSTA Bretagne
Name of the host laboratory / research team	Institut de Recherche Dupuy de Lôme (IRDL)
Address	2 rue François Verny 29806 Brest CEDEX 9
Web site	https://www.ensta-bretagne.fr/en
Name of the supervisor	Pr. David THEVENET
Function	Co-Director Multi-material assemblies Team (PTR2)
Email	David.thevenet@ensta-bretagne.fr
Phone number	+33298348807

Internship offer

Topic of the internship (title) Correlation of interfacial changes during seawater exposure of adhesively bonded structures

Proposed dates of the internship **Start:** 2019-10-07 **End** 2020-04-07

Scientific and academic objectives of the internship (detailed description of the internship content, work expected from the intern and expected outcomes):

Context: Interfacial properties are critical for the short-term and long-term performance of any mixed material structure in which components are adhered. Failure mechanisms can arise from environmental effects, internal stress, external loading and fatigue. The study of interfaces and the evolution of the quality of interfaces with environmental effects, such as immersion in seawater is critical to make lifetime predictions for components used in harsh environments.

This work has the underlying requirement that the chemical nature of the interface is not changing with time, something that is valid in most cases, except in harsh environments such as the seawater. Recent advances at ENSTA Bretagne have found a means to model reliably the behaviour of adhesive joints under cyclic loadings. Flinders has significant capability in analysing the interfacial performance of composites and structures through a unique suite of equipment that enables researchers to understand the failure mechanisms of such structures located in harsh environments. Specifically, the project will focus on stainless steels bonded with polymeric adhesives and analyse the chemical evolution of interfaces in polymer adhesively bonded stainless steels, understand the changes that occur during exposure to seawater and develop reliable models to understand and predict lifetime envelopes for adhesive joints.

Work Plan: The student will begin at the ENSTA Bretagne, in Brest, on the development of a numerical model from the experimental results obtained on a thermoset epoxy adhesive during previous works: the experimental database lies on "Butt Joint (BJ)" samples, Double Cantilever Beam (DCB) fracture tests. The student will manage to model the mechanical behaviour of an adhesive joint after water ageing focusing on the strength of the stain steel-epoxy interfaces. As the previous testing campaign was only performed on tensile tests, a second campaign may be performed to complete a multiaxial behaviour modelling with Thick Adherent Shear Tests (TAST).

The aim of the second part of the work, is to confirm the hypothesis made on the water sorption/desorption and the mechanical behaviour of the interfaces with a set of chemical and microstructural analysis. As a second step of its study, the student will analyse the interfaces and the fracture surfaces of the broken sample in order to understand the physic of the adhesion. The student will analyse and test broken samples at different ageing time in order to analyse the influence of the water sorption in adhesive joint on the properties of its interfaces. This part of the work will take place at the University of Flinders in Adelaide.

Name of industrial partner	Thalès
Role of the industrial partner in the internship project	ENSTA Bretagne, Thales and Flinders University are involved in research projects, especially in this one
Main contact at the French industrial partner	Pascale SOLE
Targeted Australian university	Flinders University
Name of lab/department/team involved in the collaboration at the Australian partner institution	Physical Sciences Building (3311) GPO Box 2100, Adelaide 5001, South Australia
Main contact in the Australian partner institution	Pr. David LEWIS
Function of the main contact in the Australian partner institution	Director Flinders Nanotechnology College of Science and Engineering
Email address of the main contact in the Australian partner institution	david.lewis@flinders.edu.au
Outside of this ongoing collaboration, will applications coming from students of other eligible Australian universities be considered by the hosting institution in France?	No

Expected profile of applicant

Level of study	Master
Discipline	Mechanical engineering
Required qualities, knowledge and skills	Mechanics of continuous media, science/physics of materials
Other specific eligibility criteria (such as citizenship requirements, language requirements, ...)	