

# INTERFACIAL PROPERTIES OF CARBON FIBRE – EPOXY COMPOSITES UNDER FATIGUE LOADING

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**Keywords:** *High-cycle fatigue, carbon fibre reinforced composites, Raman spectroscopy*

## 1 Introduction

Today, the wind turbine blade industry is looking for an alternative for glass fiber reinforced composites due to the increased size and performance requirements of the turbines. One such alternative might be carbon fiber reinforced composites.

Changing to carbon fiber requires a thorough investigation of the fatigue properties of the carbon fiber reinforced composites since the rotor blades are subjected to a unique loading spectrum. Over a 20 – to 30-year lifetime the wind blades are expected to experience  $10^8$  to  $10^9$  significant fatigue cycles [1] and the different parts of the wing will be loaded differently bringing the material into both tension – tension, compression – tension and compression – compression cyclic loading.

One of the many parameters affecting the fatigue behavior of the carbon fiber reinforced composites is the interface/interphase between the fiber and the matrix. This is the subject of this study.

In this work the interfacial properties of a carbon fiber – epoxy model composite under high cycle fatigue loading are investigated using Raman spectroscopy.

## 2 Experimental investigations

The high cycle fatigue testing equipment has been built at the department [2] and is shown in figure 1.

The equipment is based on an audio woofer which is connected to a sample mount including both a load cell and a LVDT. The setup is capable of loading the samples with a maximum load of 40 N and at a frequency up to approx. 300 Hz. The size of the equipment makes it possible to transport the setup and to fit it under the Raman microscope.

The samples used for the study are dog bone shaped specimen containing a short single carbon fiber embedded in an epoxy matrix.

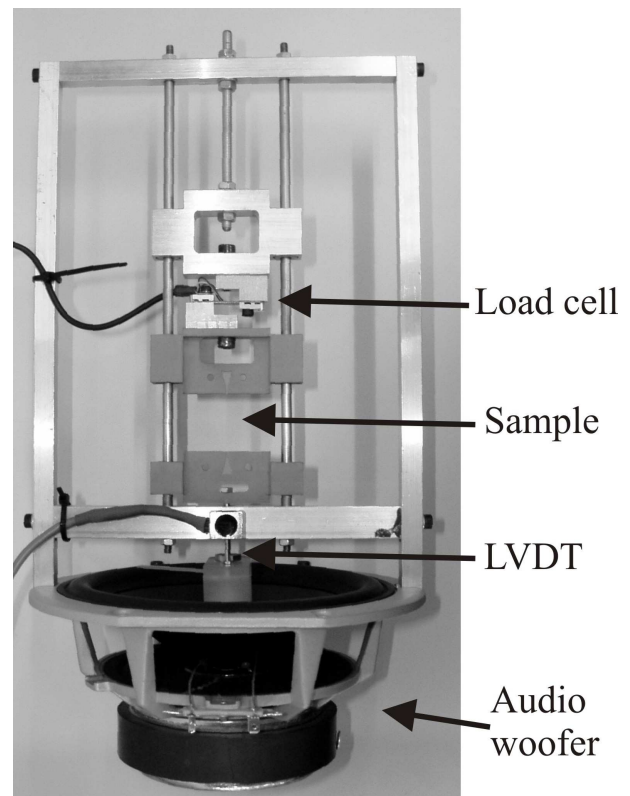


Fig. 1. Fatigue testing rig

The samples are loaded using constant strain amplitude control and up to  $10^7$  cycles. During the cyclic loading Raman measurements are performed to evaluate the straining of the carbon fiber. These measurements are used for evaluating the interfacial properties of the model composite.

## References

- [1] Mandell J.F., Samborsky D.D., Wang L. and Wahl N.K. "New fatigue data for wind turbine blade materials". *Journal of SolarEnergy Engineering*, Vol. 125, pp 506-514, 2003.
- [2] Najib W.B. "High cycle fatigue investigations of carbon fibre reinforced composites". M.Sc. thesis, Aalborg University, 2006.