Research Grants for PhD students from the China Scholarship Council

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Description of the research work proposed for a PhD:

Title: Experimental study on the mechanical behavior of green biocomposites under dynamic loads with the effect of thermal degradation.

Keywords: large strain, high strain rate, green biocomposites , SHPB, dynamic behaviour, thermal degradation

Subject:

I. Context

Recently bio-based composites are in the development stage. Nevertheless, the fully bio-based thermoset epoxy resins still need to meet sufficient degree of maturation, to be approved for advantageous implementation to ensure their industrial development. The term 'Green biocomposites' is used for those composite materials where both 'reinforcement' and 'epoxy matrix' are biobased. In this context, plant fibres, such as flax replace the fiberglass in many applications, not only because of their low energy production cost but also due to their weight reducing capacity, which is a principal criterion for transport applications. However, the drawbacks of low thermal stability and poor fire resistance have received little attention so far and few literatures focused on the dynamic behaviour of flax/epoxy biocomposites after thermal degradation under impact and choc, such as failure mechanisms, delamination, energy absorption, etc.

II. Work plan and expected results

Particularly the problem of delamination needs more attention since it can cause significant damages in biocomposite laminates. In order to reduce the delamination damages, Tufting, a single thread method is proposed. Tufting generates thread through-thickness reinforcement without interlocking the threads. Additionally, fire retardant treatments are employed to enhance thermal stability and fire resistance.

A 20mm diameter steel Hopkinson pressure bar (SHPB) tests will be performed on the biocomposites . The SHPB is a powerful tool to study the behaviour of materials at high strain rates. Dynamic compression tests will be performed on flax/epoxy biocomposites with and without tufting reinforcement and with and without fire retardant treatments to obtain the dynamic mechanical

characteristics. The comparison of these test results will help to understand the effect of tufting reinforcement and fire retardant treatments on the failure mechanisms and to optimizer the conception of biocomposites.