Friction in Landing Gear Systems

(A Multiscale Simulation Approach)

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Introduction:

The performance of materials in friction applications has until now typically been verified by empirical testing. The experimental methodologies are prone to be **expensive**, **time consuming** and only validated for a **specific conditions and materials**. Therefore, this research seeks to develop and verify **multi-physics modelling techniques** to enable end-to-end performance based design of friction systems and reduce the dependency on physical testing. The physiochemical processes shall be captured at micro/nano scale using numerical simulations. Then a macroscale model of the brake wear would compare the previous experimental evidence.

Hypothesis:

- Friction Mechanisms at the braking surface are dependent upon microstructural features.
- Multi-physics aspects of friction performance can be modelled
- A multi-fidelity approach to modelling for design and development purposes is feasible
- Multi-physics modelling techniques of this nature could be developed and applied to similar empirically verified systems.
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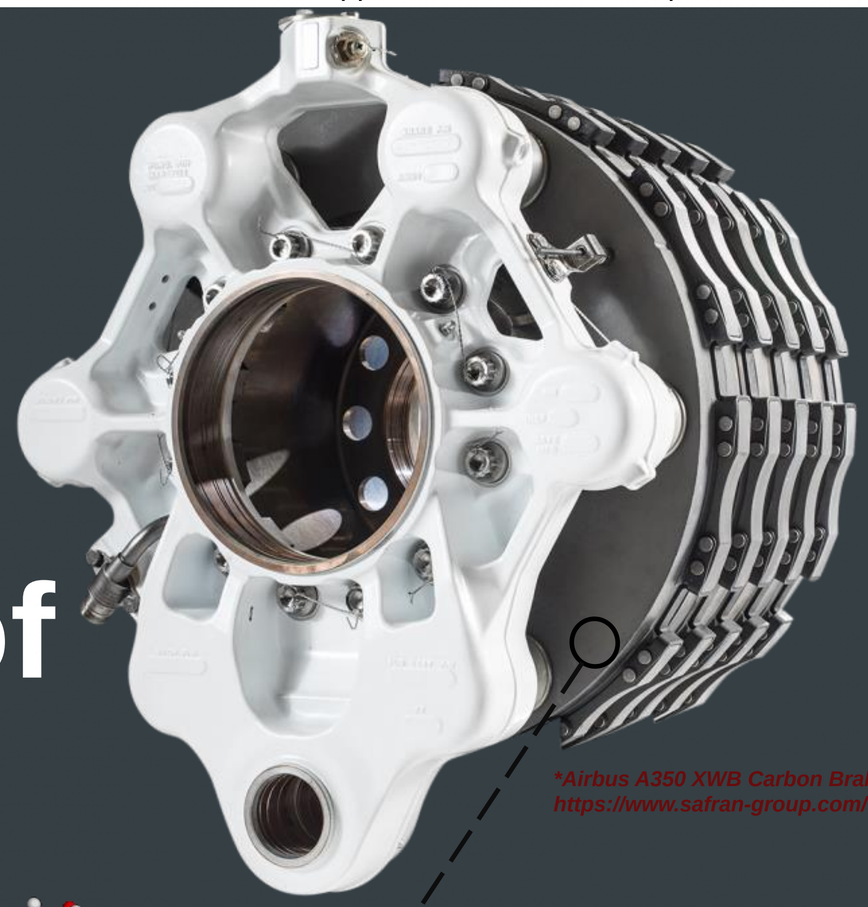
Method of work:

This research has quantitative approach by identifying and answering hypothesis based on collecting and analysing numerical data.

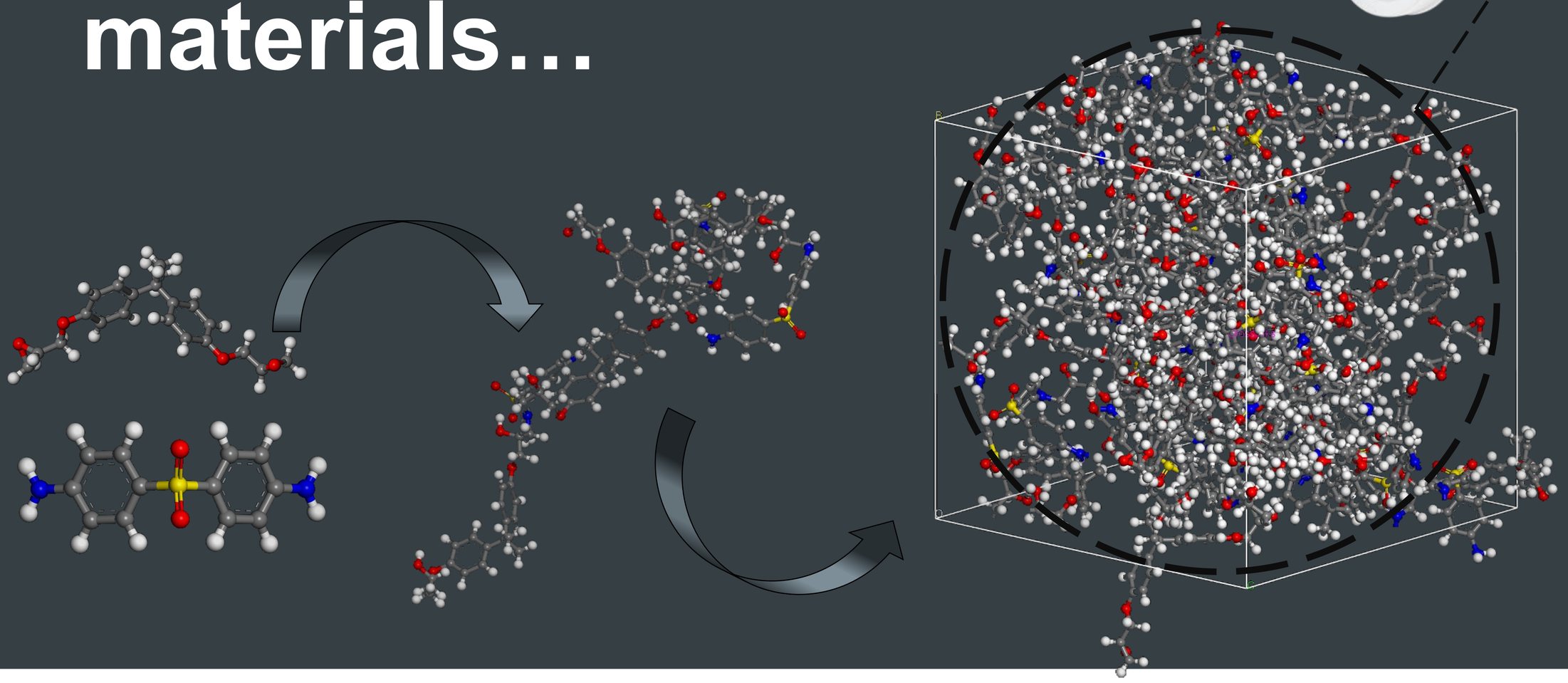
These data are mainly collected from simulations and some experimental tests. Also there are some data collected from existing studies, mainly from the industrial partner “Airbus SAS”.

Collaboration with Airbus SAS would create a path to take steps of the project in the direction of market requirements and make sure the considered methodologies are either verified previously or feasible to be applied for current developments.

Verified a multiscale simulation approach to design and enhance tribological properties of advanced friction materials…

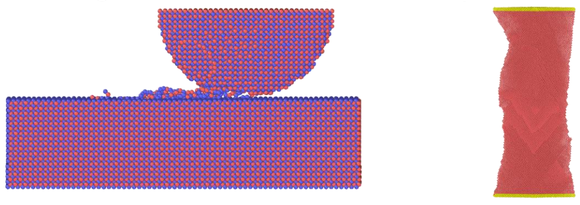


*Airbus A350 XWB Carbon Brake: https://www.safran-group.com/



Results:

- Friction Mechanisms at the braking surface are dependent upon microstructural features.



- A multi-fidelity approach to modelling for design and development purposes found feasible.
- Multi-physics modelling techniques of this nature could be developed and applied to similar empirically verified systems.

Discussion:

Multiphysics modelling of complex empirically verified multi-dimensional engineering systems could contribute to a reduction in **cost** and **lead-time** of creating solutions to product challenges throughout the aircraft lifecycle.

Achieving this has been made feasible with the use of powerful simulation tools such as LAMMPS, BIOVIA simulation software packages and so many other available tools within industry and academic sectors.

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