

Evaluation of Wear vs Fibre Orientation for a Composite Bicycle Chainwheel

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Introduction

Carbon fibre composites are becoming increasingly popular in the cycling industry. However, there is limited knowledge on the performance of carbon fibre drivetrain components. This project aims to identify the effect of fibre orientation on the wear of a bicycle chainring.

Project objectives:

- Design and manufacture carbon fibre chainring samples.
- Test chainring samples using a designed and commissioned test rig.
- Evaluate the wear of the samples using optical and electron microscopes.

Chainring Manufacture

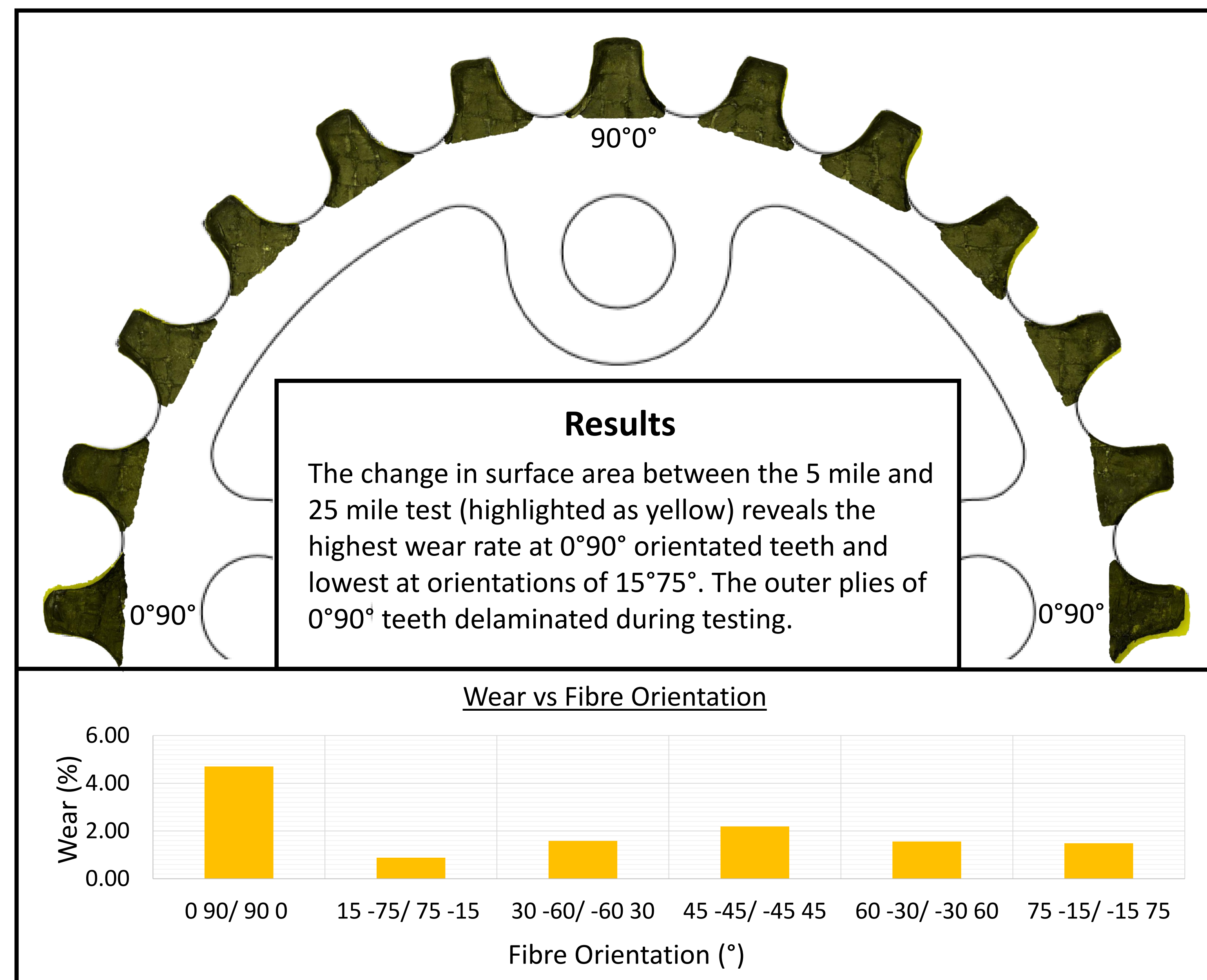
- The chainring was designed in Solidworks, using industry standard dimensions.
- Plain woven pre-impregnated carbon fibre plies were cut to shape.
- Plies laid up into a two piece MDF mould.
- All plies aligned to keep individual tooth orientation consistent throughout the laminate.
- Vacuum bagged and oven cured, consolidation pressure created by the two piece mould.



Mechanical Testing

Two prototype chainrings were attached to a street bicycle and physically tested. A test route was selected and repeated for each physical test. Data was recorded using Strava, a GPS tracking application. Chainrings were tested in 5 mile increments, optical micrographs were taken after each test.

- High void content in first prototype caused premature failure in the first test.
- The second prototype achieved a distance of 25 miles before failure.



Conclusion and Future Recommendations

- The experimental results indicate that the carbon fibre orientation influences the tribological performance of the chainring. The fibre orientation can therefore be optimised to reduce component wear. However, only one set of data was obtained and the chainrings were not tested under constant load.
- Results could be validated by acquiring more data and using a more controlled testing regime.