WM9C8-15 Polymeric and Composite Processing

24/25

Department
> WMG

Level
> Taught Postgraduate Level

Module leader
> Neill Raath

Credit value
> 15

Module duration
> 5 days

Assessment
> 100% coursework

Study location
> University of Warwick main campus, Coventry

Description

Introductory description

With the increased need for lightweighting, and advances in materials technology, polymers and polymer composites are being applied in automotive applications in greater volumes. This module will equip students with comprehensive knowledge of different polymer classes, including properties, processing techniques and finishing operations. Students will gain an understanding of the environmental considerations of utilising polymers, as well as the CAE techniques to predict component behaviour.

Module aims

To enable automotive engineers to analyse and evaluate the use of the full range of composite materials and processes

To provide comprehensive knowledge of different classes of polymers, their key properties, and characteristics, including processing techniques and post-finishing operations.

To provide appreciation of robust design principles of selecting polymer and manufacturing processes.

To provide comprehensive knowledge to enable students to take into account component performance, design for manufacture and assembly, light-weighting potential, manufacturing

volumes, investment, LCA and repairability for each material type.

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

Polymer classes (thermoplastics, thermosets and elastomers)
Natural composites
Material properties (Physical, Thermal, Chemical, Reinforced and unreinforced polymer properties)
Polymer and composite processing methods
Joining methods
Repairability
Decoration (Painting, Plating, Graining)
Prediction of properties
CAE methods
Advanced Modelling Methods
Moldflow
Design for parts
Practical lab-based sessions (when circumstances allow)

Learning outcomes

By the end of the module, students should be able to:

- Evaluation of appropriate automotive manufacture/use of polymers and/or composites, taking into account environmental impacts and material, tooling and infrastructure investment costs.
- Conceptual creation of an advanced component or vehicle architecture; taking into account material/manufacturing process selection based on structural performance, weight and cost saving and other key design requirements.
- Evaluate the benefits of a reinforced and unreinforced polymer component in a range of vehicle structural applications as well as evaluating the opportunities for product enhancement and light-weighting.
- Interpret the applications of virtual validation and CAE methods to ensure robust polymer solutions for vehicle implementation.

Indicative reading list

Introduction to Composite Materials Design, E.J. Barbero. CRC Press, 2010. ISBN: 9781420079159

Composite Engineering and Structures for Engineering Students, S. Grove. Kindle Direct Publishing, 2018. ISBN: 978-1983344800

Analysis and Performance of Fiber Composites, B.D.Agarwal, L.J. Broutman, K. Chandrashekhara, Wiley, 2017. ISBN: 0471511528

Green composites : natural and waste-based composites for a sustainable future, C. Baillie and R. Jayasinghe. Woodhead Publishing, 2017. ISBN: 9780081008003

Principles of the manufacturing of composite materials, S.V. Hoa. DEStech Publications, 2018. ISBN: 9781605954219

Reinforced polymer composites: processing, characterization and post life cycle assessment, P.K. Bajpai and I. Singh. Wiley, 2020. ISBN: 9783527820962

Recycling of polymers : methods, characterization and applications, R. Francis. Wiley, 2016. ISBN: 9783527689002

Handbook of polymers, G. Wypych. ChemTec Publishing, 2016. ISBN: 9781927885116

High performance polymers, J.K. Fink. William Andrew Publishing, 2014. ISBN: 9780323311434

[View reading list on Talis Aspire](#)

Subject specific skills

The module will develop the following subject specific skills: Appraisal of the suitability of a polymer or polymeric composite for specific automotive applications, Critical analysis of the difference in environmental impact between different processing methods; Evaluation of the appropriate material for specific automotive applications.

Transferable skills

Collaborative working, Critical thinking and analysis, Academic writing skills

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Study

Study time

Type	Required
Lectures	25 sessions of 1 hour (17%)
Seminars	6 sessions of 1 hour (4%)
Tutorials	3 sessions of 1 hour (2%)
Practical classes	3 sessions of (0%)
Supervised practical classes	5 sessions of 1 hour (3%)
Online learning (independent)	51 sessions of 1 hour (34%)
Assessment	60 hours (40%)
Total	150 hours

Private study description

No private study requirements defined for this module.

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time	Eligible for self-certification
Post-module Assessment	80%	48 hours	Yes (extension)

A written report investigating the environmental and manufacturing effects of implementing the optimal material for a selected automotive component/system. This report will consider areas such
as suitable material properties and processing techniques, environmental impact of utilising materials and performing processing, sustainability of composites, investment costs, joining technologies, and end-of-life environmental impact.

	Weighting	Study time	Eligible for self-certification
In-module Assessment	20%	12 hours	No

Critical evaluation of implementing a composite component in an automotive application, considering areas such as suitable material properties, processing, environmental impact and cost.

Feedback on assessment

In-class debrief of performance on in-module activity. Written feedback, of approximately 300 - 400 words, will be provided 4 weeks after the date of submission of the PMA. The feedback will be focussed on the strengths and weaknesses of the work with regards to the module learning objectives and the post module assessment marking guidelines. Suggestions for improvement will also be provided.
A formative peer review will be included, with results to be shared with student.

Availability

There is currently no information about the courses for which this module is core or optional.