# WM9D1-15 Metal 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

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## Description

## Introductory description

Metals are a well-established material for automotive use, and when used and processed appropriately, can be used to achieve lightweight structures. This module will give a sound grounding in traditional, and state-of-the-art, metal processing techniques. Students will gain an advanced understanding of how the suitability of a metal is related to its properties, processability and cost. Students will also gain practical experience of metal forming simulation techniques. Students will also gain an understanding of the environmental impact of metal processing.

## Module aims

To introduce traditional metal processing techniques applicable to the automotive industry, as well as knowledge at the forefront of metal processing technologies. The module provides an advanced understanding of a material's suitability in relation to its properties, processability and economics.
To provide a sound understanding of the benefits of modelling tools.
To provide insights into state-of-the-art and upcoming processing methods.
To provide an advanced understanding of environmental considerations and costs associated with metal processing.

## 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.

- Material properties related to processing parameters
- Formability testing theory
- Conventional stamping technology
- Non-conventional processes
- Steels and aluminium processing
- Variation modelling and process control
- Dimensional assessment
- Overview of presses and related equipment
- Defects
- Forming simulations practical
- Economics of forming and material utilisation
- Springback
- Environmental impact of metal processing
- How environmentally friendly manufacturing changes affect material processing (i.e. paint bake ovens)
- Lab-based practical sessions (when circumstances allow)

## Learning outcomes

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

- Evaluate how forming methodologies affect material properties.
- Evaluate several materials' suitability for a specific application in relation to their properties, formability and economics.
- Interpret the environmental impact of different metal processing technologies in terms of energy usage, material waste and emissions.
- Creatively envision the use of state-of-the-art forming technologies in place of conventional technologies.
- Evaluate the benefits of modelling tools in terms of material utilisation, economics and part quality
- Interpret and evaluate metrology data.

## Indicative reading list

Materials and manufacturing processes, K. Kumar, H. Kalita, D. Zindani and J.P. Davim. Springer, 2019. ISBN: 9783030210663

Multiscale modelling in sheet metal forming, D. Banabic. Springer, 2016. ISBN: 9783319440705.

Advances in metal forming : expert system for metal forming, R.S. Hingole. Springer Verlag, 2015. ISBN: 9783662444979

Sustainable manufacturing : challenges, solutions and implementation perspectives, R.Stark, G. Seliger, J. Bonvoisin. SpringerOpen, 2017. ISBN: 9783319485140

View reading list on Talis Aspire

## Subject specific skills

The module will develop the following subject specific skills: Appraisal of the suitability of a metal for specific automotive applications, Practical experience of performing CAE forming simulations, Critical analysis of the difference in environmental impact between different processing methods.

## Transferable skills

Collaborative working, Critical thinking and analysis, Academic writing skills

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## Study

## Study time

| Type | Required |
|---|---|
| Lectures | 20 sessions of 1 hour (13%) |
| Seminars | 3 sessions of 1 hour (2%) |
| Tutorials | 2 sessions of 1 hour (1%) |
| Supervised practical classes | 5 sessions of 1 hour (3%) |
| Online learning (independent) | 60 sessions of 1 hour (40%) |
| 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.

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## 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 metal for a selected automotive component/system. This report will consider areas such as economics of forming, environmental impact of metal processing methods, processing defects, and dimensional control.

| | | | |
|---|---|---|---|
| In-module Assessment | 20% | 12 hours | No |

Critical evaluation of implementing optimal material for an automotive applciation, considering aspects such as environmental effects, material embodied energy, economics, engineering considerations.

### 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.

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## Availability

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