

Student Feedback & Marking Report

Student: Laurence Browne (2415273)

Module: ACMA4000 – Materials and Introduction to Processing

Assessment: Manufacturing Processes and Defects (Report 40% + Video 10%)

REPORT MARKING (40%)

1. Engagement with Literature Skills

Mark Awarded: 18 / 20

The report demonstrates strong engagement with a broad and relevant body of technical and academic literature across metals, polymers/elastomers and infrared optics. The steel punch section is supported by appropriate heat treatment and surface engineering sources (Engineerfix; Fractory), and the use of transformation diagrams and annealing stages shows engagement with metallurgical literature. The anti-vibration mount section is supported by manufacturer technical data (Hutchinson PLC) and vibration engineering resources (Vibration Research University), which are used effectively to justify damping behaviour and transmissibility. The thermal camera lens section is well supported by specialist optics literature (FLIR, Fluke, Thorlabs, Sinoptix, Femtum), and the comparison with barium fluoride and chalcogenide glasses demonstrates good breadth of literature use. The inclusion of numerical data (e.g. transmissibility ratios, refractive index, wavelength transmission ranges, germanium cost) shows effective use of sources to support claims.

The main limitation is that the literature base is dominated by industry and technical web sources, with limited use of core academic textbooks or peer-reviewed journal literature in materials science (e.g. Callister, Ashby) to underpin structure–property explanations, particularly for steels and elastomers. While appropriate for application-focused sections, the academic depth could be strengthened by integrating at least one authoritative materials science text or peer-reviewed paper for each material class. In addition, lifecycle and environmental impact claims are largely qualitative and would benefit from inclusion of independent LCA literature.

2. Knowledge and Understanding Skills

Mark Awarded: 20 / 25

The submission demonstrates very strong technical understanding of materials, processing and structure–property–performance relationships. The steel punch section accurately explains annealing, austenite formation, pearlite, martensite formation through quenching, and tempering to balance hardness and toughness. The microstructural discussion is well developed for Level 4 and correctly links heat treatment routes to mechanical performance and service durability. The anti-vibration mount section correctly characterises neoprene as a vulcanised elastomer with viscoelastic damping behaviour and explains how fillers and plasticisers influence stiffness and damping characteristics. The transmissibility discussion and resonance behaviour show good understanding of dynamic mechanical performance rather than only static properties. The thermal camera lens section demonstrates strong understanding of germanium's optical properties in the infrared, its high

refractive index, single-crystal structure, and the implications for manufacturing (diamond turning, polishing, anti-reflection coatings, DLC protection).

Thermal property understanding is appropriate, including recognition that germanium lenses are limited by service temperature despite high melting point, and that elastomer performance is constrained by operating temperature range. Mechanical and thermal property comparisons are technically sound and appropriately linked to application requirements. Minor scope for improvement lies in more explicit comparison of bonding types (metallic vs covalent/ionic vs polymer chain interactions) to further strengthen conceptual depth. Overall, the level of knowledge and understanding is excellent for Level 4.

3. Cognitive and Intellectual Skills

Mark Awarded: 17 / 20

The report demonstrates strong evaluative reasoning in material selection and alternatives. The steel punch evaluation appropriately balances hardenability, core ductility and surface hardness, and considers alternative designs such as tungsten-tipped punches, correctly identifying cost–performance trade-offs. The anti-vibration mount comparison between neoprene and silicone is well supported by quantitative data (operating temperature range, transmissibility, natural frequency), demonstrating structured comparison and informed judgement. The thermal camera lens comparison between germanium and barium fluoride (and chalcogenide glasses) shows clear evaluation of trade-offs between optical transmission range, temperature resistance, hardness, manufacturability and cost. The discussion of supply chain risk for germanium and strategic material considerations demonstrates higher-level evaluative thinking.

The evaluation is evidence-based and well structured. To further strengthen this criterion, the student could make the prioritisation of design criteria more explicit (e.g. weighting optical performance over cost for thermal imaging lenses, or damping performance over recyclability for mounts) in a simple decision framework. Nonetheless, the evaluative reasoning is strong.

4. Practical Application Skills

Mark Awarded: 21 / 25

The application of materials and manufacturing theory to real-world products is outstanding. The chosen objects are technically appropriate and allow rich application of processing and materials concepts. Manufacturing routes are described in realistic industrial terms, including CNC turning, heat treatment batch processing, co-moulding of elastomers with aluminium inserts, diamond machining of germanium blanks, anti-reflection coatings and DLC protection. Health and safety considerations (e.g. germanium dust hazards and PPE) demonstrate applied industrial awareness. Production volume differences and their impact on process choice and cost are clearly articulated.

The report is very well supported by figures and tables, including annealing stage tables, transmissibility graphs, optical transmission curves and comparative property tables. In line with the marking approach, the strong and integrated use of photos, tables, graphs and diagrams justifies a very generous mark in this criterion. The visuals are well referenced and analytically discussed rather

than merely illustrative. The only minor enhancement would be the inclusion of a consolidated lifecycle flow diagram for each product to visualise raw material extraction, manufacture, use and end-of-life, but this is not essential given the overall strength of application.

5. Transferable Skills for Life and Professional Practice

Mark Awarded: 9 / 10

The report is professionally structured with a clear abstract, contents page, logical sectioning aligned with the coursework brief, and a coherent conclusion. The writing is clear, technically precise and well organised. Figures and tables are clearly labelled and integrated into the narrative. Referencing is comprehensive and demonstrates good academic practice in terms of breadth and traceability of sources. The presentation shows strong professional communication skills appropriate for engineering practice.

Minor weaknesses include occasional typographical errors and minor formatting inconsistencies in figure/table captions. These do not detract significantly from overall professional quality.

VIDEO PRESENTATION MARKING (10%)

Mark Awarded: 7 / 10

The video demonstrates strong technical understanding of the three selected products and their associated materials and manufacturing processes. The student clearly explains the rationale for material choice in each case, including heat-treated steel for punches, elastomeric behaviour for anti-vibration mounts, and germanium for thermal camera lenses. The explanations are accurate and demonstrate awareness of structure–property–performance relationships, particularly in relation to hardness and toughness trade-offs in steels, damping behaviour in elastomers, and optical transmission requirements in infrared optics.

The presentation is logically structured and communicates technical content clearly. The student articulates comparative trade-offs between original and alternative materials, including cost, manufacturability, performance and supply chain considerations, demonstrating evaluative thinking rather than purely descriptive reporting. The verbal explanations are coherent and aligned with the written report.

Visual reinforcement in the video is present but could be strengthened further. While products and processes are discussed clearly, the inclusion of simple on-screen process flow diagrams (e.g. heat treatment cycle for steel, transmissibility curves for elastomers, optical transmission curves for germanium) or concise comparison tables would further enhance technical communication and clarity. The conclusion could also be slightly more explicit in synthesising the main engineering trade-offs across the three case studies.

Overall Summary

Report marks:

Engagement with Literature: 18/20

Knowledge and Understanding: 20/25

Cognitive and Intellectual Skills: 17/20

Practical Application: 21/25

Transferable Skills: 9/10

Video mark: 7/10