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Processing of Customized Automotive and Oil and Gas Components – Nickel Aluminium Bronze and Aluminium Silicon Material by Using Metal Casting Techniques

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The academic year of 20112022 which begins in October 2021 where students continue to undertake their face-to-face lecture or laboratory sessions as restrictions imposed by the MCO are gradually being eased up. As such for Foundry Lab of FTKMA, several laboratories sessions are slotted to expose students to the manufacturing process by means of metal casting technique. For 20 BVA students enrolling into the BVA 1064 Automotive Component Fabrication course, they are exposed to the casting steps in manufacturing metallic-based automotive components. Several examples are used such as the rotor propeller and pipe fitting part as described by Figure 7 and Figure 8, respectively. Each part is unique as it's developed by its pattern, assembled in a moulding flask before finally being set to metal pouring session. The alloy used is an aluminium silicon alloy which is melted up to 660°C, tapped for pouring into the cavity, and allowed to solidify to room temperature.

For the seven students undertaking the final year project, they are tasked to fabricate two components, namely the archery holder component and pump casing connector for oil and gas component assembly. In a similar process with previous automotive components, both components are developed by its pattern, assembled in moulding flask, and set to metal pouring session. The alloy material used is aluminium silicon alloy (LM3) which is heated to its molten temperature of 680°C, tapped to pour into the cavity, and allowed to solidify at room temperature, as shown in Figure 9. The final components are shown in Figures 10 and 11 respectively.

Figure 7. Rotor propeller

Figure 8. Pipe fitting part

Figure 9. Molten metal pouring process

After each pouring is allowed to fully cured and solidified, all the components gating and risering system will be removed for physical inspection to the product. The part will then be sectioned, and the cross-section to be visually examined. Later it's the phase to extract a small piece from the finished component as specimen, ground, and polished to further observe its microstructural characteristics for process improvement and optimisation.

For another session involving postgraduate students, the alloy investigated is nickel aluminium bronze (NAB), which is intended for use under a corrosive environment. This time, the alloy can be produced by alloying the mixture up to 1100°C. However, upon sectioning and further inspection on the microstructure behaviours reveals commonly encountered issues in casting process - porosity, warranting that going forward, further work in the processing improvement for NAB material is deemed necessary.

References

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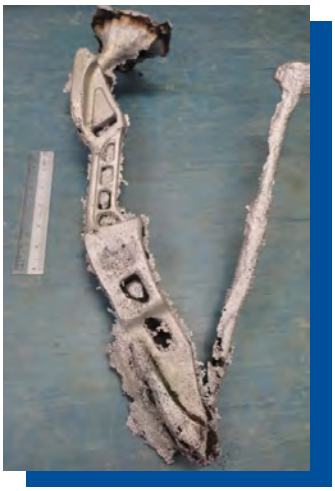

Figure 10. Example of archery holder component

Figure 11. Example of pump casing connector