Improvement of Mechanical Properties and Yield for Aluminium Bronze (AB2) Casting

Student's Name	**B. Shanmuga Raja**	**AMT (FT-2012)**
Academic Supervisor(s)	N. S. Mahesh	
Industrial Supervisor(s)	Rangaswamy, M. V. Industries, Bangalore	

B. Shanmuga Raja
mailshanmuga@yahoo.co.in
Ph. No: 0 98860 77975

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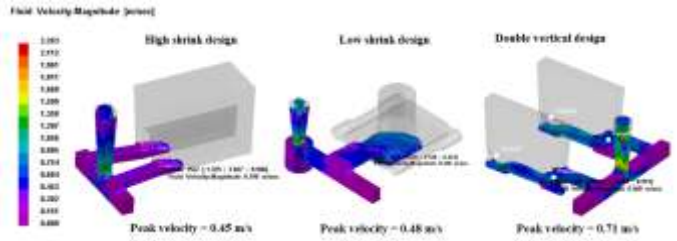
Abstract:

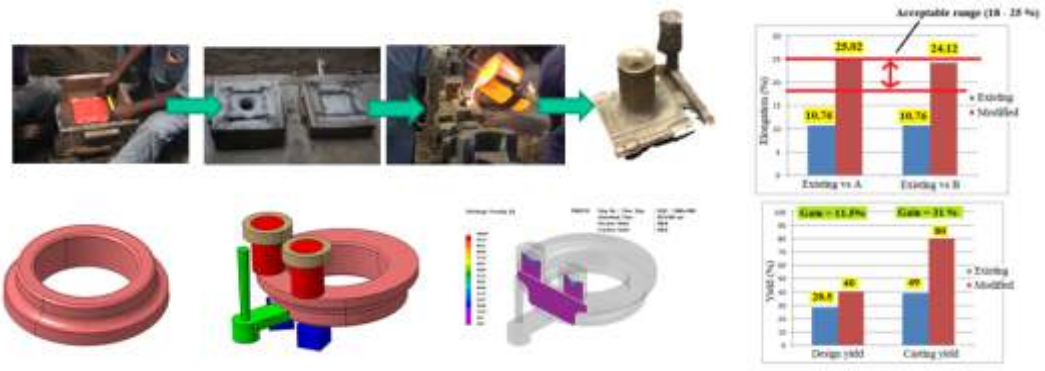
Aluminium bronze (AB2) offers combinational benefits of excellent cavitation, corrosion resistance and mechanical properties, making it ideal choice for hydraulic and marine applications. A foundry manufacturing AB2 bushes encountered poor strength and elongation in sand castings and its test coupon. Moreover, there was a need to improve casting yield for economic advantage.

The objective of the project was to improve, elongation to a range of 18 – 25% and to increase yield by 10%. Existing practices were studied for foundry practice followed and data on mechanical properties and yield was collected. Existing test coupon and component were modelled in CATIA V5 and analysed for fill, flow, temperature gradient and defects, using ProCAST numerical simulation and root causes for low mechanical properties were identified. ASTM test coupon designs were analysed and ASTM low shrinkage test coupon was suggested as an ideal choice for casting aluminium bronze (AB2). Casting trial was carried out for test coupon validation. Mechanical testing were carried out on standard test coupon which was prepared for tension test in accordance with ASTM E8 / E8M exemplified high mechanical properties for tensile, yield and elongation. Elongation was improved to an average of 24.5%, tensile strength to an average 632 MPa and yield strength to an average of 322 MPa. Microstructural analysis revealed fine grain size of average 13 µm in existing test coupon caused due to chilling effect. The average grain size was 30 µm on recommended test coupon and component. Gas porosities of average 17 µm were evident in component. Casting redesign and gating-riser redesign was carried out to improve the yield. Process simulation was carried out on the improvised design to validate and ascertain absence of shrinkage and air entrapment. Casting geometry redesign resulted, yield gain of 11.5% and gating, riser redesign improved yield by 31%. Net yield of 42.5% was predicted and numerically validated using ProCAST.

Existing design



Simulation of ASTM B208 casting test coupon



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