Multiphysics CAE Simulations of Casting Process for First-time-right Product Development

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Introduction:In Casting Process Liquid Material is usually Poured Into a Mould of desired Shape and then allowed to Solidify.Casting product performance dependence on Material,Flow,Process Temperature,Solidification,Shrinkage and Residual Stress.In a casting process not all available resources are utilized effectively which results in low quality of casting, defects and Metal wastage.Physics based Modelling is increasingly used to optimise product performance,improve quality and reduce defects of casting products.In this poster phase change solidification process of alloy wheel is investigated for process performance and optimisation.

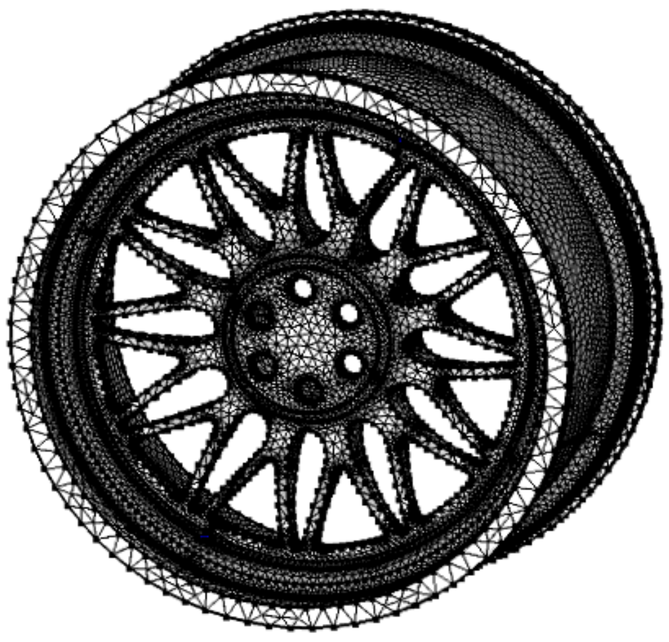

Fig 1. CAD Model of Casted Aluminium Alloy Wheel

Computational Methods: Heat transfer module of COMSOL with Phase change physics is used.2D axisymmetric model is considered for this investigation.In the casting process of alloy wheel,a significant amount of latent heat is released during the phase transition process.The location of the transition front between the molten and solid state is a strong function of the casting flow and the cooling rate.

Results:Transient Simulation results of solidification process of alloy wheel is shown.Figure 2 shows contour plots of liquid solid transition phase and temperature profile at 15 seconds. .

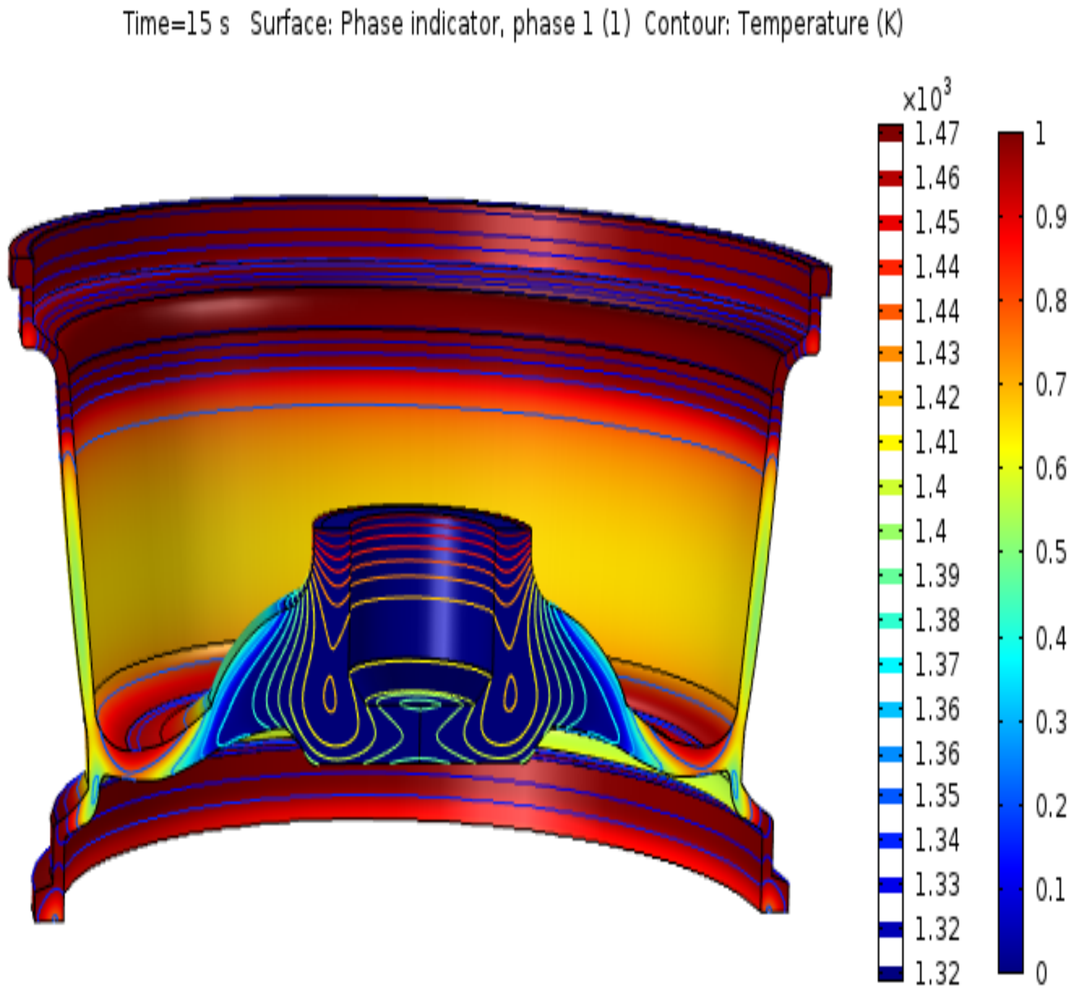

Figure 2. Typical Contour plots of Liquid solid transition phase and temperature profile at 15 seconds

Conclusions:Heat transfer with phase change physics of alloy wheel casting process is modelled for process performance optimisation.This study will be further used to predict the properties profile of the casted parts.Coupled flow,heat transfer and phase change solidification process modelling of casting process will enable first time right casting product development.

References

Rajkolhe R et.al,Defects Causes and Their Remedies in Casting Process:A Review, International Journal of Research in Advent Technology, Vol.2, No.3, 2014.