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A SURVEY APPROACH OF NUMERICAL CALCULATION OF ULTIMATE TENSILE STRENGTH OF COMPOSITES

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Abstract

Thousands of consumers, commercial, and industrial products can be produced by die casting process with high volume ranging from small to large components and hence die casting can be referred as mass production process. Die casting process is significantly used in the industry for its high productivity and less post machining requirement. Due to light weight and good formability, aluminum die casting plays an important role in the production of transportation and vehicle components. Some of the products produced by die casting was defective and hence needs to improve the performance of the process. The objective of the present work is to evaluate the effect of injection pressure parameter (process as well as dimension) on the dimensional stability of the die cast part. In order to investigate the effect, process parameters such as injection pressure the RSM model and GA was developed for each response. Analysis of variance (ANOVA) for each response has been also carried out to find out the influence factors and their interactions.

Keywords: *Die Casting Process; Gating; Process Parameter, Response; Optimization.*

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1. Introduction

Composite materials are engineered or naturally occurring materials made from two or more constituent materials with extensively different properties that is physical and chemical which remain separate and dissimilar at macroscopic and microscopic scale within the finished structure. These are materials that comprise strong load carrying material known as reinforcement imbedded in weaker material known as matrix. Reinforcement provides strength and rigidity, helping to support structural load. The matrix or binder (organic or inorganic) maintains the position and orientation of the reinforcement. The reinforcement may be particles, platelets or fibres and are usually added to improve mechanical property such as stiffness, strength and toughness of the matrix material. Long fibres that are oriented in the direction of loading offer the most efficient load transfer. Some of the following

properties improved by to forming composite material are wear resistance, fatigue life, stiffness, thermal insulation, corrosion resistance, strength, acoustical insulation, temperature dependent behaviour etc.

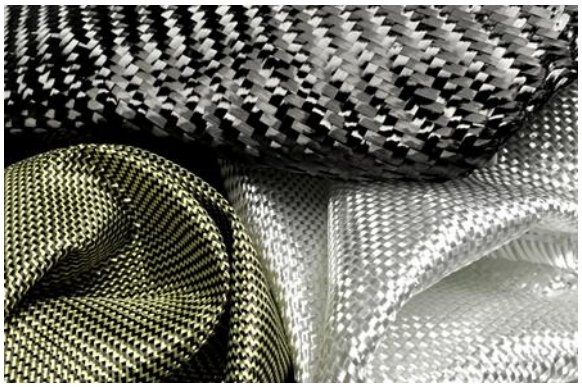

Figure 1. Composite Material

2. Types of Composites

In some broad way composite materials can be classified into three groups in the basis of matrix materials.

- Polymer matrix composites
- Metal matrix composites
- Ceramic matrix composites
- Hybrid composites

3. Characteristics of Composite Material

The characteristics of composite material are as followings:

a. High specific modules and strength
b. High fatigue strength
c. Anisotropic nature
d. Corrosion resistance and durability
e. Low coefficient of thermal expansion

4. Literature Review

Maria Virginia Quintana et al. [1] they have presented the analysis of free vibration of plates by Ritz variational approach with internal hinges distributed along a straight line. First order shear deformation theory is used to

modelling of the plate and symmetric stacking sequences taken for the plate. In which the results show the effect of line hinge parameters on natural frequencies and mode shapes for symmetric multilayered plates.

M. Amabili et al. [2] they have compared the first and higher order shear deformation theory and classical Von Karman theory for study of nonlinear forced vibration of laminate composite and isotropic plates. In which the boundary condition of plates is simply supported with immovable edges. In this study the frequency response curves for large amplitude vibration is almost same in all the three theories for isotropic material but for laminated composite plate for thick plate difference arises and for thin plate again it is almost same for all the three theories.

A. V. Borgaonkar et al. [3] they have used Statistical Energy Analysis (SEA) to study the vibrational response of idealized subsystem made up of composite material theoretically. This analysis method largely depends on the damping loss factors, the modal densities and coupling loss factors of the subsystem. In which for rectangular composite plate of fibre glass modal density obtained by theoretically and experimentally. Also analyse the effect of ply orientation on modal density for same sized plate.

Sang Kwon Lee et al. [4] they have presented the analysis of effect of various ply orientation on acoustic and vibration responses of rectangular CFRP plates. First the harmonic force is applied to calculate vibration and acoustic response for CFRP plates theoretically and compared it with numerical solutions. Experimental solution is also presented for acoustic and vibration response of CFRP plates.

S. Sarangan et al. [5] they have used non-polynomial zigzag theories with finite element formulation for prediction of free vibration and bending analysis of sandwich and laminated composite plates. In which the mathematical model is combination of non-polynomial shear strain functions and zigzag theories and the variation of transverse displacement is constant.

S. Ganesh et al. [6] they have analysis the free vibration analysis of composite plate using equivalent single layer theory with finite element method. In which two types of boundary condition have taken i.e. cantilever type and simply supported type. They also calculate the deformation in composite plate at various points by analytical and computational approach.

R. Muni Rami Reddy et al. [7] they have worked thin and thick multilayered composite plate of graphene nano-platelets for the analysis of free vibration behavior by first order shear deformation theory with finite element approach. Using Halpin-Tsai model effective young's modulus and distribution type calculated for each layer of composite plate. Mass density and Poisson's ratio are calculated by rule of mixture.

Nayak et al. [8] they have presented Glass-carbon/epoxy hybrid composite panels for parametric study of vibration and buckling by experimental and numerical investigation. In which the effect of lamination sequence is also

calculated for natural frequencies of vibration and buckling strength. FFT analyser, accelerometer and impact hammer excitation are used for study of vibration.

Mehar et al. [9] they have presented the nonlinear bending responses of the MW-CNT-reinforced composite plate are computed numerically using a novel higher order nonlinear FE model. The current developed model is validated by comparing the present numerical results with available benchmark results and subsequent in-house experimentally obtained data. For the current theoretical analysis, the effective material properties of the composite plate are computed using the Mori–Tanaka scheme. For the experimental analysis, the MW-CNT reinforced composite plate is fabricated using the hand lay-up technique.

Shelly Simcha et al. [10] they have concluded from the experimental results that Titania coating obtained from a sol-gel method is a preferable surface treatment for enhancement of thermo-mechanical properties of epoxy nanocomposites, without causing a significant increase in viscosity, a crucial parameter for filament winding resin systems. A maximum increase of about 10% in Tg has been achieved for the two epoxy matrices containing 0.05–0.3 wt % Titania coated MWCNT. An increase of 30% in the storage modulus has been achieved for LY556/Amine hardener A/DY026 matrix containing 0.3 wt % titania coated MWCNT.

5. Conclusions

In this chapter, detailed discussions about the thermal effect and flow effect field characteristics of vortex tube with different nozzle inlet shape, number of nozzles, and axial angle have been presented. For 3-D space, a 3-D model and for viscous models a k-ε (2 equa.), simulation has been required at a steady state time dependency with RNG turbulence model with a standard wall function condition has been considered for present models.

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