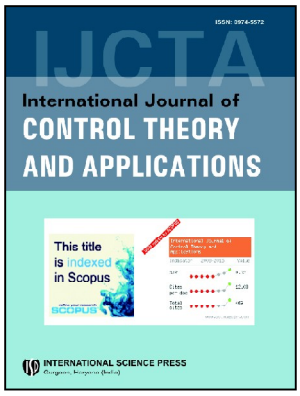

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Comparative Investigation and FE Analysis of Exhuast Manifold with Different Ceramic Powders By Ansys

Koganti Meghana[#1] and Y V Hanumantha Rao[*2]

[#1]Mechanical Department, Koneru Lakshmaiah University, Guntur, Andhra Pradesh, India, E-mail: kogantimeghana@gmail.com
*[*2] Professor, Mechanical Department, Koneru Lakshmaiah University, Guntur, Andhra Pradesh, India, E-mail: dryvhrao@kluniversity.in*

Abstract: Background/Objectives Corrosion associated wear problems are of use in selection of merchandise and other business applications. Utilising deposits on surface has become a standard technique. Methods/Statistical Analysis: In this paper ceramic powders are used on the bases of ANSYS analysis. For investigation of thermal distribution and mechanical properties of manifold, flow analysis method is applied. Findings: Analysis for 3D models is carried out by CATIA & ANSYS Transient, details are compared to optimise the choice of powders. Total deformations, Von mises stress, total heat flux, are studied. It is found that when the temperature applied is less, the aluminium coated manifold works better. Application/Improvements: Low effect of crystalline refinement on smooth surface can be observed with greater details by incorporating more number of powders.

Keyword: Ceramic powders, Efficiency, Analysis, ANSYS, Exhaust manifold

I. INTRODUCTION

From the past years Corrosion [1] associated degree of wear problems are important in moving good selection of business applications and merchandise. Various technologies are going to deposit the suitable surface protection which will resist lowering place inexplicit conditions. This paper is regarding the manifold with utterly completely different ceramic powders [2] by ANSYS analysis [3].

To investigate the thermal stress distribution and mechanical properties of exhaust manifold with different ceramic materials, flow analysis is carried out by ANSYS software. A parametric study of exhaust manifold by varying the three dimensional parameters is also carried out.

II. METHODOLOGY

Modeling and analysis of 3-D models of the manifolds were carried out using CATIA and ANSYS software. Thermal [8] and mechanical properties of these manifolds were found. Flow characterization will be carried out by the computational fluid dynamics. Producing solid ceramic parts are not invariably the most effective approach to determine wear or corrosion issues. In some cases, taking first the aluminiferous and applying a ceramic

coating may be the most effective resolution. Ceramic coatings [4] will vary from case to case. The brief explanation of methodology can be shown in fig. 1.

III. RESULTS AND DISCUSSIONS

(A) Total Deformation

Deformation may be caused by external loads, body forces (such as gravity or electromagnetic forces), or changes in temperature, moisture content, or chemical reactions, etc. Strain is a description of deformation in terms of relative displacement of particles in the body that excludes rigid-body motions. Different equivalent choices may be made for the expression of a strain field depending on whether it is defined with respect to the initial or the final configuration of the body and on whether the metric or its dual is considered. In a continuous body, a deformation field results from a stress field induced by applied forces or is due to changes in the temperature field inside the body. The relation between stresses and induced strains is expressed by constitutive equations, e.g., Hooke's law for linear elastic materials. Here the materials having lesser deformation with titania coated. Therefore its having good material strength which is withstanding the temperature.

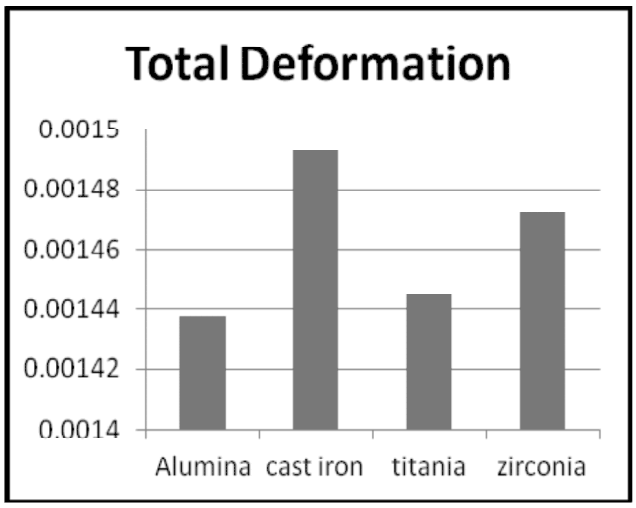
(B) Von mises stress

In materials science and engineering the von Mises yield criterion can be also formulated in terms of the von Mises stress or equivalent tensile stress, a scalar stress value that can be computed from the Cauchy stress tensor. In this case, a material is said to start yielding when its von Mises stress reaches a critical value known as the yield strength. The von Mises stress is used to predict yielding of materials under any loading condition from results of simple uniaxial tensile tests. The von Mises stress satisfies the property that two stress states with equal distortion energy have equal von Mises stress.

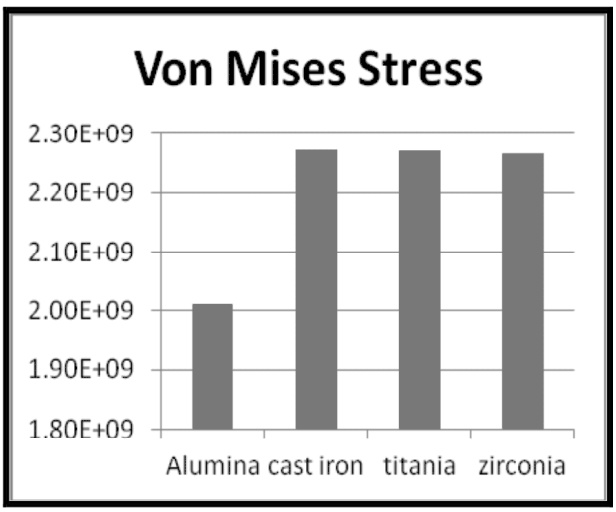
In this results shows that lower of von mises stress which is lead to the good strength and materials.

(C) Total Heat Flux

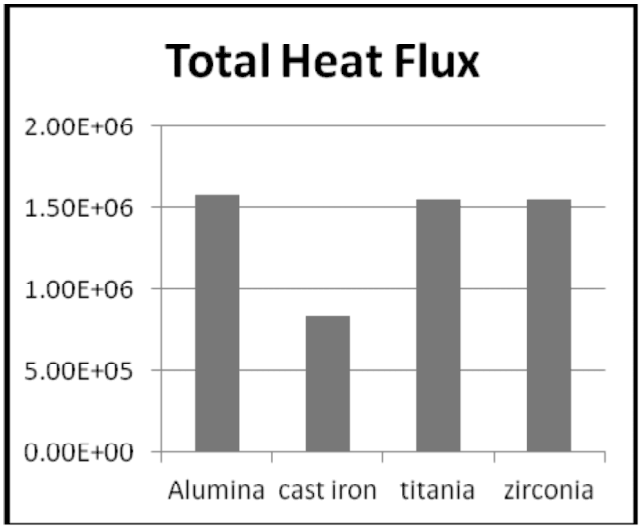
Heat flux or thermal flux is the rate of heat energy transfer through a given surface per unit time. In a basic sense it is a derived quantity since it involves, in principle, two quantities viz. the amount of heat transfer per unit time and the area from/to which this heat transfer takes place. In practice, the heat flux is measured by the change in temperature brought about by its effect on a sensor of known area. The incident heat flux may set up either a steady state temperature field or a transient temperature field within the sensor. The temperature field set up may either be perpendicular to the direction of heat flux or parallel to the direction of heat flux. Here the alumina



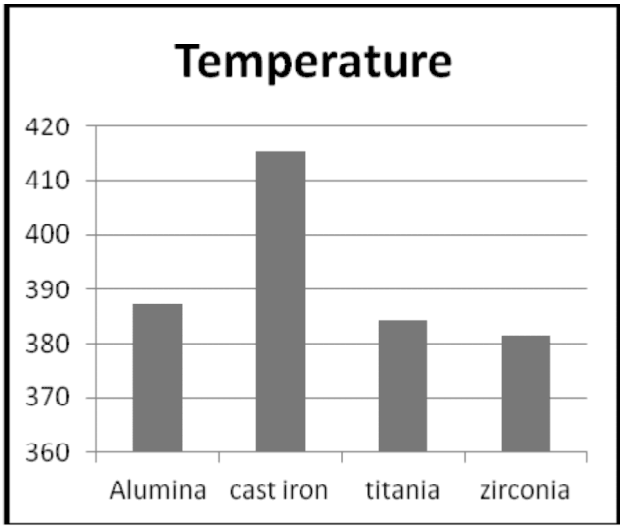
a) Total Deformation



b) Von mises stress



c) Total Heat flux



d) Temperature

coated exhaust manifold provides more heat flux than the other ceramic coated manifolds. Which is tend to reduce the heat affected areas in the manifold.

(D) Temperature

From the results shown, it is clear that after application of the temperature load, exhaust manifold surface is having very less heat available on it, so that alumina coated manifold withstand the lesser heat.

(E) Figures and Tables

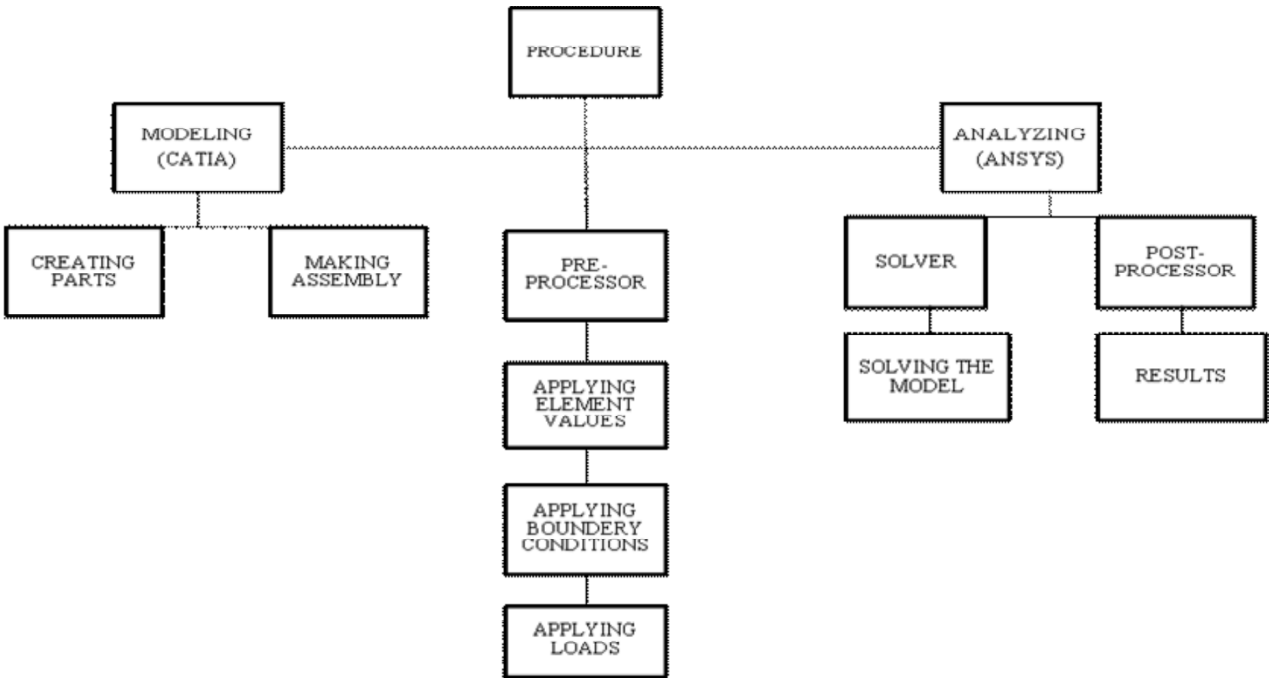


Figure 1: Methodology Sequences

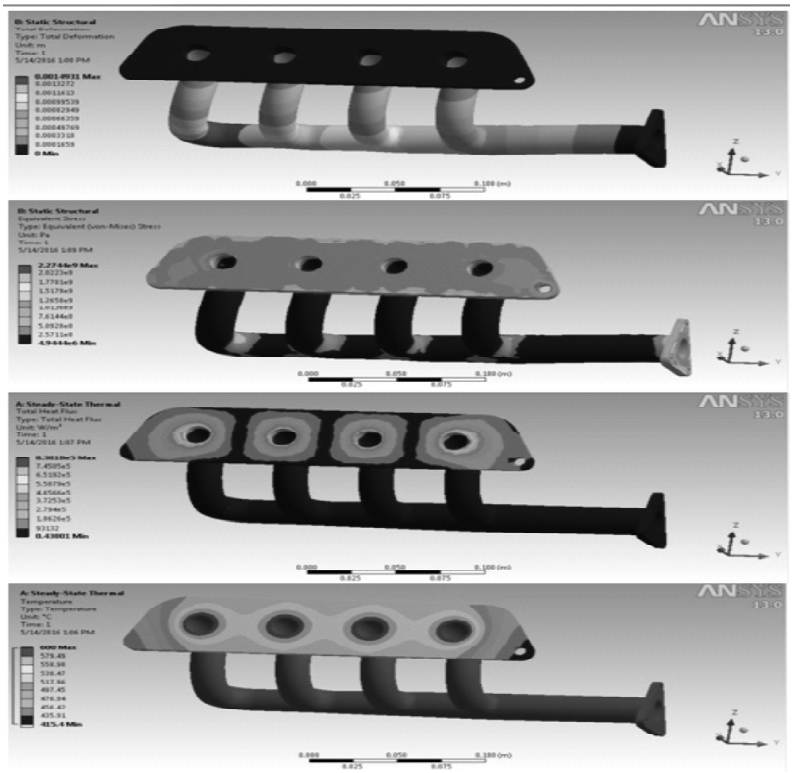


Figure 2: Results showing Total Deformation, Von-mises stress, heat flux and temperature for cast

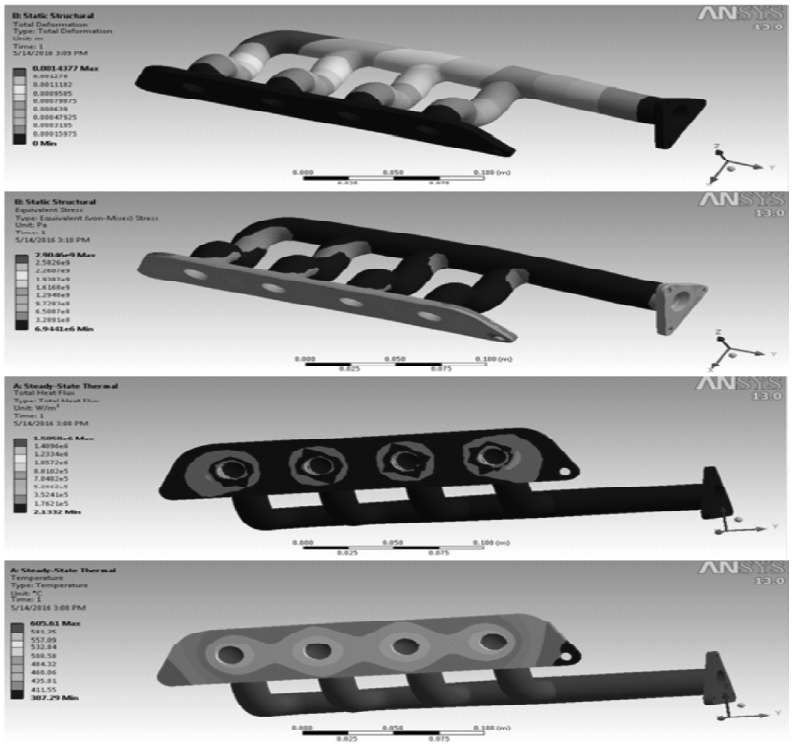


Figure 3: Results showing Total Deformation, Von-mises stress, heat flux and temperature for cast iron coated with alumina

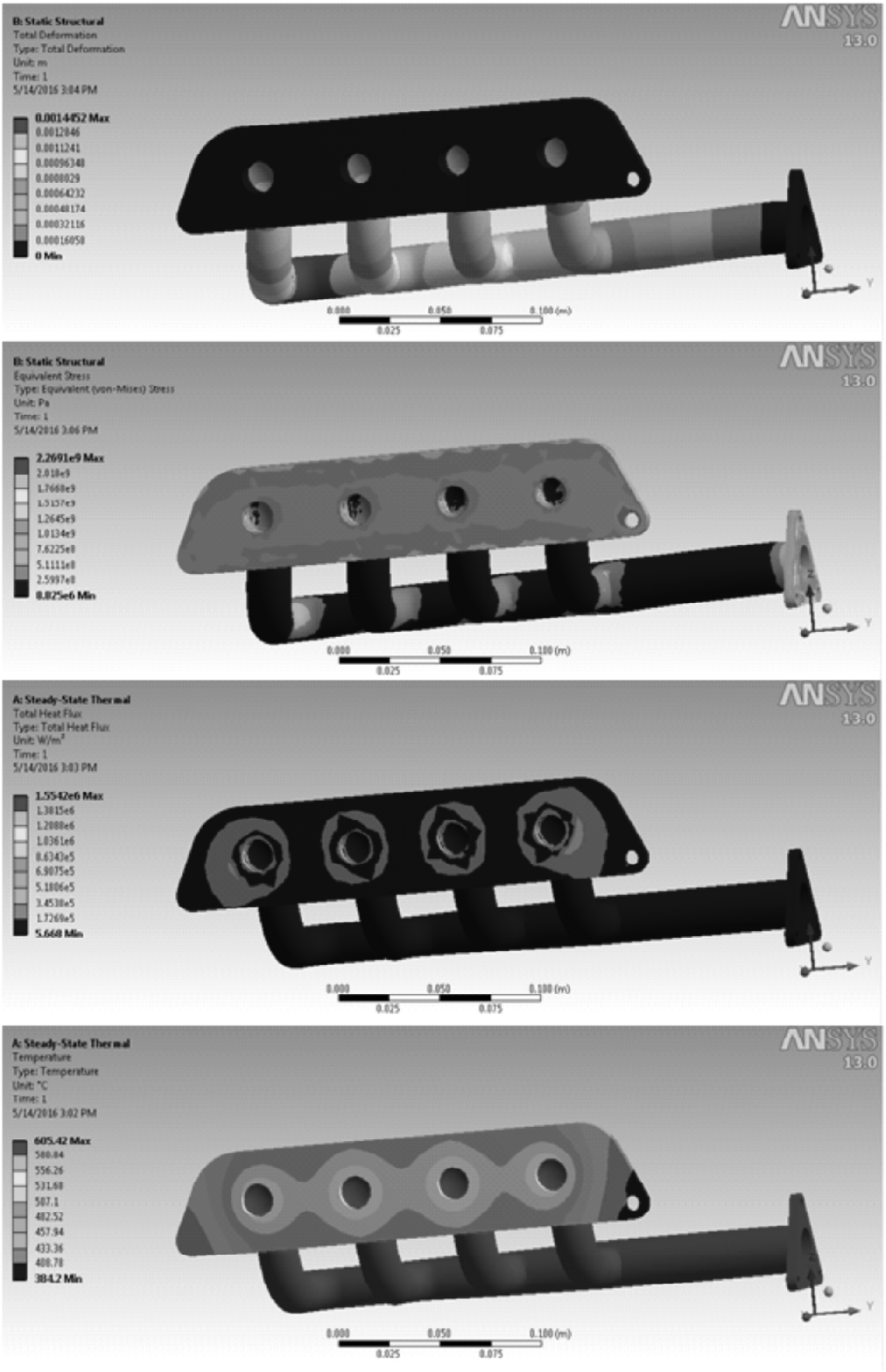


Figure 4: Results showing Total Deformation, Von-mises stress, heat flux and temperature for cast iron coated with Titania

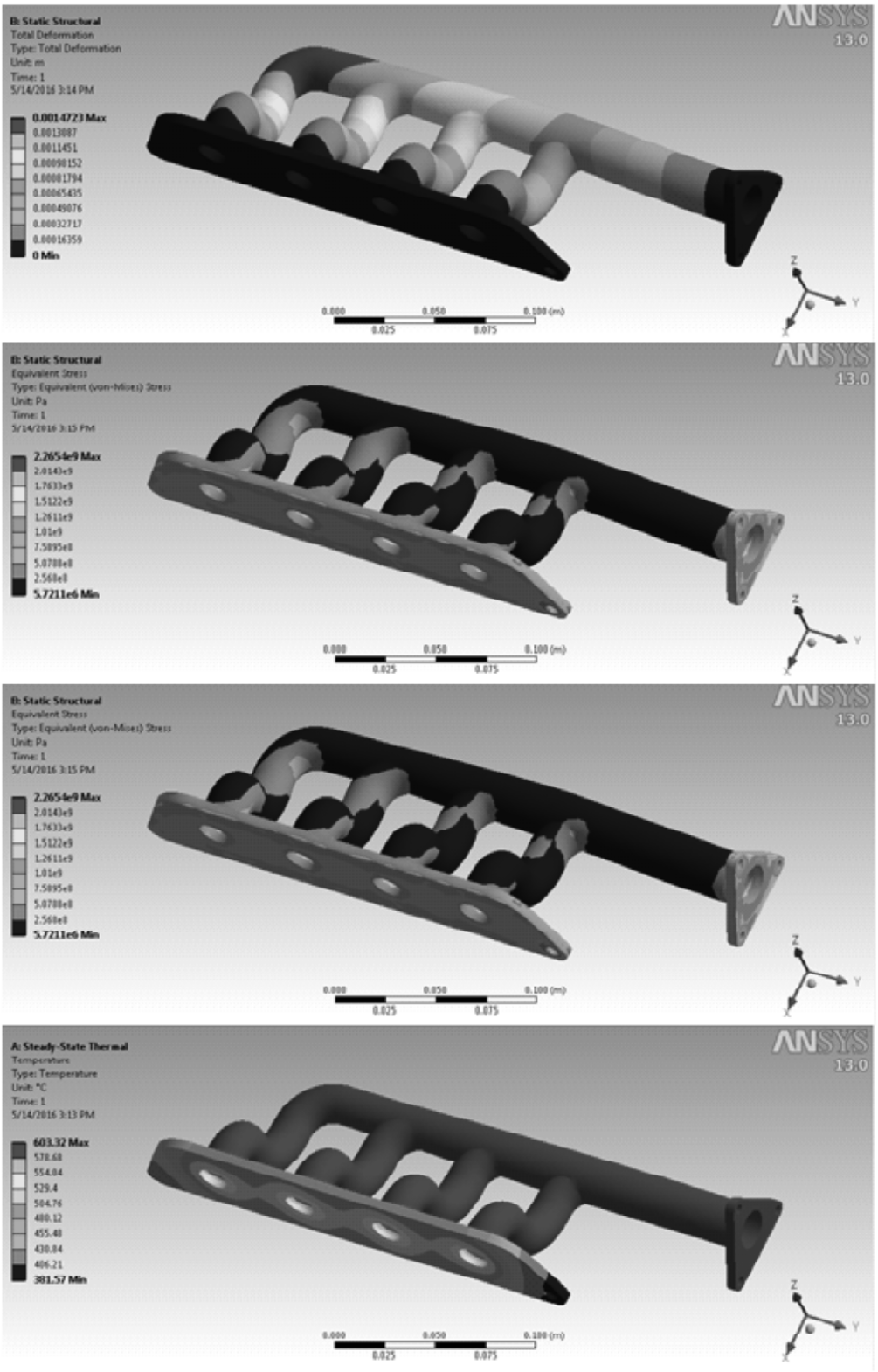


Figure 5: Results showing Total Deformation, Von-mises stress, heat flux and temperature for cast iron coated with zirconia

IV. CONCLUSION

From the obtained numerical results it was found that, the coating on exhaust manifold specimens by thermal spray coatings were investigated by ANSYS and CFD[9], [14] software. The surface morphologies of the major and minor faces were considerably different from each other. Due the coating on exhaust manifold material like cast iron will improve the mechanical and thermal characterization. This will further improve the hardness, structural grains and thermal properties. Also the alumina-titania coatings will provide the most dramatic improvements over zirconia and other ceramic powders, in engine component applications where failure mechanisms that are driven by high temperatures and chemical diffusion are important for life. In lower temperature applications (lower speeds, discontinuous contact) the coating will still offer improved performance due to the effects of crystallite refinement, which provide a smoother surface and second phase crack arresting or deflection mechanisms that make the coating tougher.

REFERENCES

[1] De Waard, C., and D. E. Milliams. "Carbonic acid corrosion of steel."Corrosion 31, no. 5 (1975): 177-181.

[2] Pratsinis, Sotiris E. "Flame aerosol synthesis of ceramic powders." Progress in Energy and Combustion Science 24, no. 3 (1998): 197-219.

[3] Moaveni, Saeed. Finite element analysis: theory and application with ANSYS. Pearson Education India, 2003.

[4] Mansarunomato, "The effect of geometry on stiffness and deformation in Exhaust Manifolds for inline four Cylinder Engines", SAE paper 2003-01-0409.

[5] Agastheesh, M. Guru, and S. Senthil Selvan. "Behaviour of Cold Formed Steel Starred Section Subjected to Axial and Eccentric Load Condition." Indian Journal of Science and Technology 9, no. 23 (2016).

[6] Santa Rao, K., G. Musalaiah, and K. Mohana Krishna Chowdary. "Finite Element Analysis of a Four Wheeler Automobile Car Chassis." Indian Journal of Science and Technology 9, no. 2 (2016).

[7] Anand, M. Dev, N. L. Maharaja, K. Sanu Kailordson, and N. Prabhu. "Theoretical Study and Analysis on Performance Enhancement of a Ceramic Monolith Heat Exchanger." Indian Journal of Science and Technology 9, no. 13 (2016).

[8] Oktay, Hasan, Zeki Argunhan, Recep Yumrutaþ, Mehmet Zerrakki Iþýk, and Neþe Budak. "An Investigation Of The Influence Of Thermo physical Properties of Multilayer Walls And Roofs On The Dynamic Thermal Characteristics." Mugla Journal of Science and Technology 2, no. 1 (2016): 48-54.

[9] Nikhil, R. "Design and Analysis of Feed Check Valve as Control Valve Using CFD Software." IJITR 4, no. 3 (2016): 2938-2943.

[10] Krishnakumar, Ajinkya, Parth Sharma, Yash Tambi, and B. Ashok. "Establishing Temperature Dependency of the Aerodynamic Drag using CFD and Experimental Analysis." Indian Journal of Science and Technology 9, no. 31 (2016).

[11] P. Fauchais and A. Vardelle, Thermal Sprayed Coatings Used Against Corrosion and Corrosive Wear,SPCTS, UMR 7315, University of Limoges, France.

[12] S. Narasimha Kumar, K. Kishor, M. V. S.Murali Krishna, and P.V. K. Murthy, Studies on Exhaust Emissions from Copper-Coated Gasohol Run Spark Ignition Engine with Catalytic Converter, International Scholarly Research Network ISRN Mechanical Engineering, Volume 2011, Article ID 757019, 6 pages, doi:10.5402/2011/757019.

[13] Subodh Kumar Sharma, P. K. Saini, N. K. Samria, Modelling and analysis of radial thermal stresses and temperature field in diesel engine valves with and without air cavity, International Journal of Engineering, Science and Technology, Vol. 5, No. 3, 2013, pp. 93-105

[14] K.M Pandey & Bidesh Roy, CFD Analysis of Intake Valve for Port Petrol Injection SI Engine, Global Journal of Researches in Engineering, Mechanical and Mechanics Engineering, Volume 12 Issue 5 Version 1.0 Type: Double Blind Peer Reviewed International Research Journal, Online ISSN: 2249-4596 Print ISSN:0975-5861.