International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 10, October 2017
www.ijarse.com
IJARSE
ISSN 2319 - 8354

THERMAL ANALYSIS ON NONMETALS SUBJECTED TO CONFINED SPACE

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ABSTRACT

A confined space is a space with limited entry. In case of concentric spherical shells heat transfer takes place. At present in this work Thermal analysis on non metals subjected to confined space, where air is taken as common confined gas. Whereas for the spherical shell two different shell materials has been chosen from the families of non metals. The outer shell and inner shell are maintained at several temperature sources namely335K, 364K, 395K & 424K. Diamond (C) and Silica Aero-Gel are considered as non metals. For analyzing thermal analysis ANSYS software is used.

Keywords*: *ANSYS, Confined gas, Non-Metals, Spherical Shell, Temperature

I. INTRODUCTON

Convective heat transfer is the transfer of heat from one place to another place by the movement of fluids. Heat transfer by means of convection combines the processes of unknown conduction (heat diffusion) and advection (heat transfer by bulk fluid flow). To refer cumulative transport the term convection is used and to refer the transport due to bulk fluid motion the term advection is used. The properties of convective heat transfer can be evaluated at one convenient reference point, that point is called average fluid temperature or bulk temperature.

S.No.	Materials	Thermal Conductivity (K) (W/m K)
1	Diamond	2000
2	Silica Aero-Gel	0.024

Table No: 1 K Values

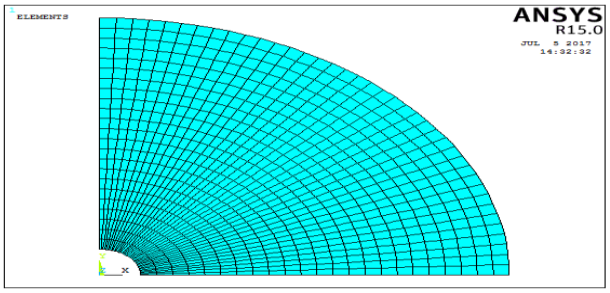

Fig No: 1 Mesh Geometry

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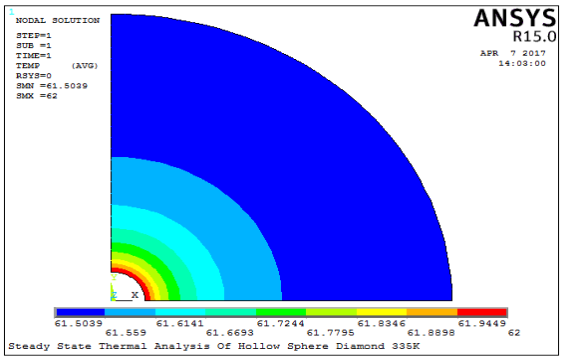

Fig No: 2a

t = 335K

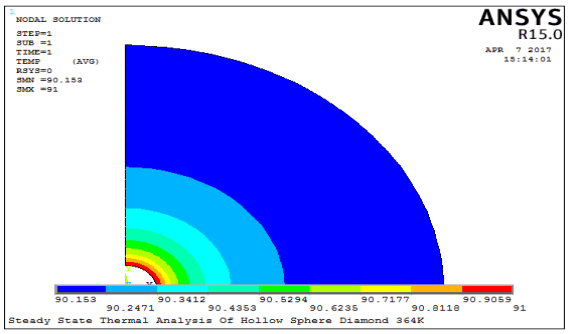

Fig No: 2b

t = 364K

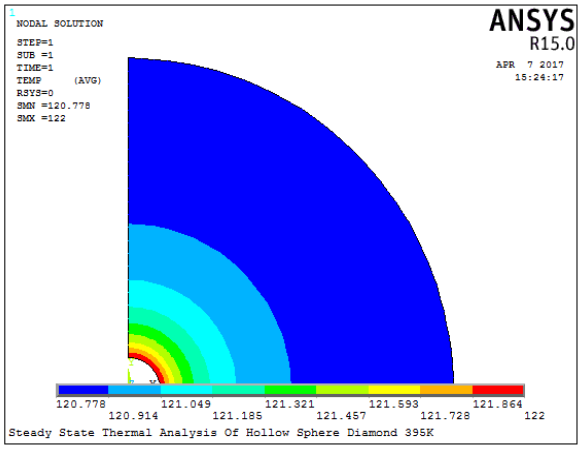

Fig No: 2c

t = 395K

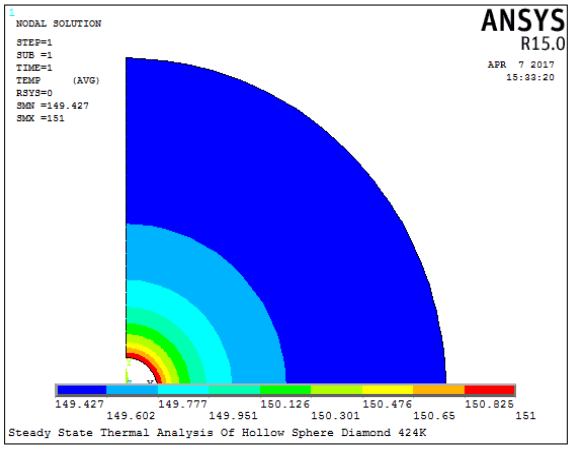

Fig No: 2d

t = 424K

Nodal Solutions for Steady State Temperature Distribution in Case of Diamond Material

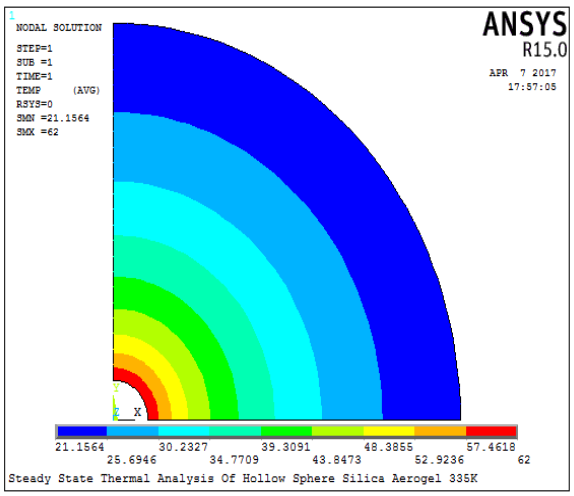

Fig No: 3a

t = 335K

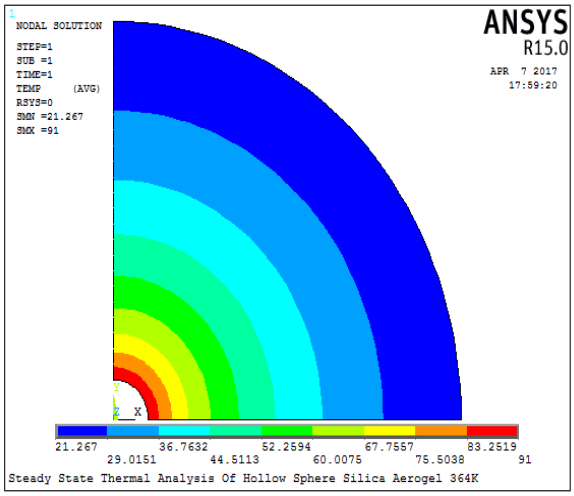

Fig No: 3b

t = 364K

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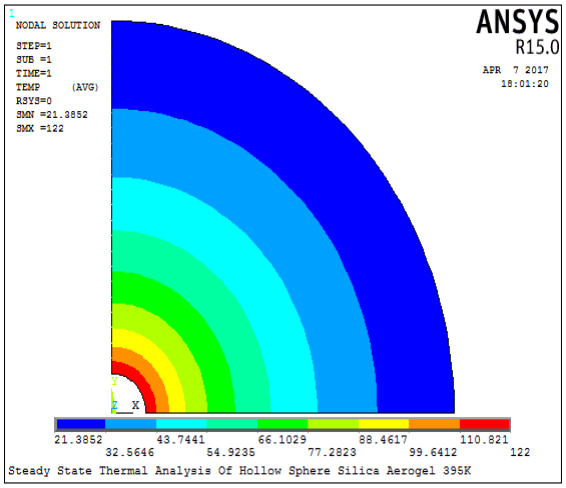


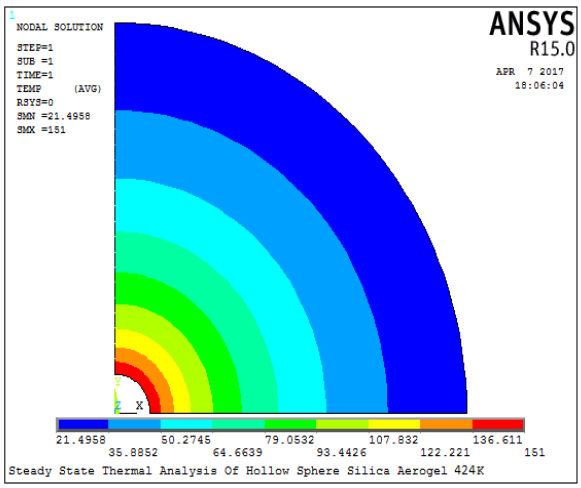


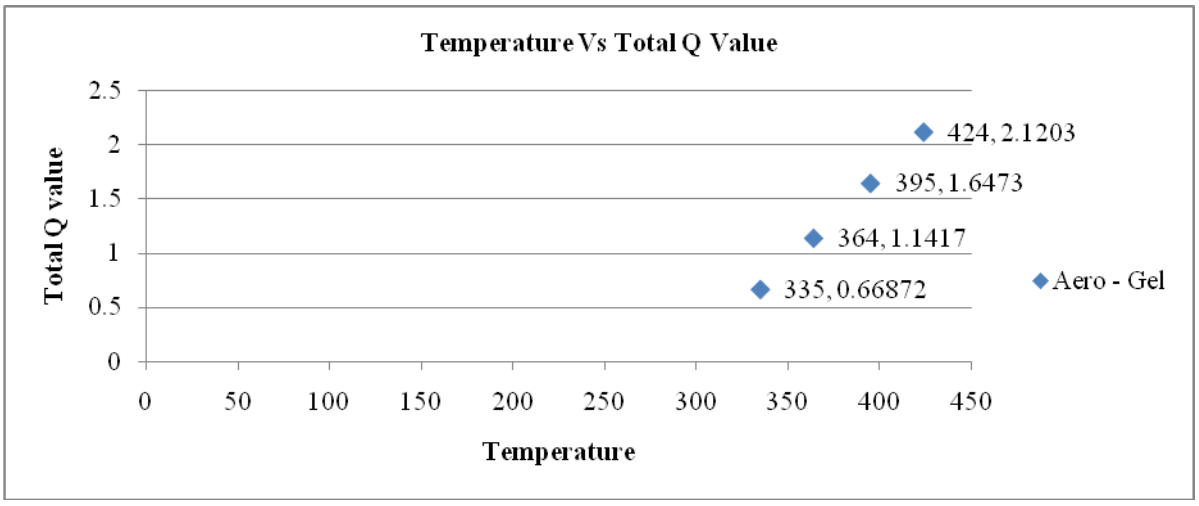
Fig No: 3c

t = 395K

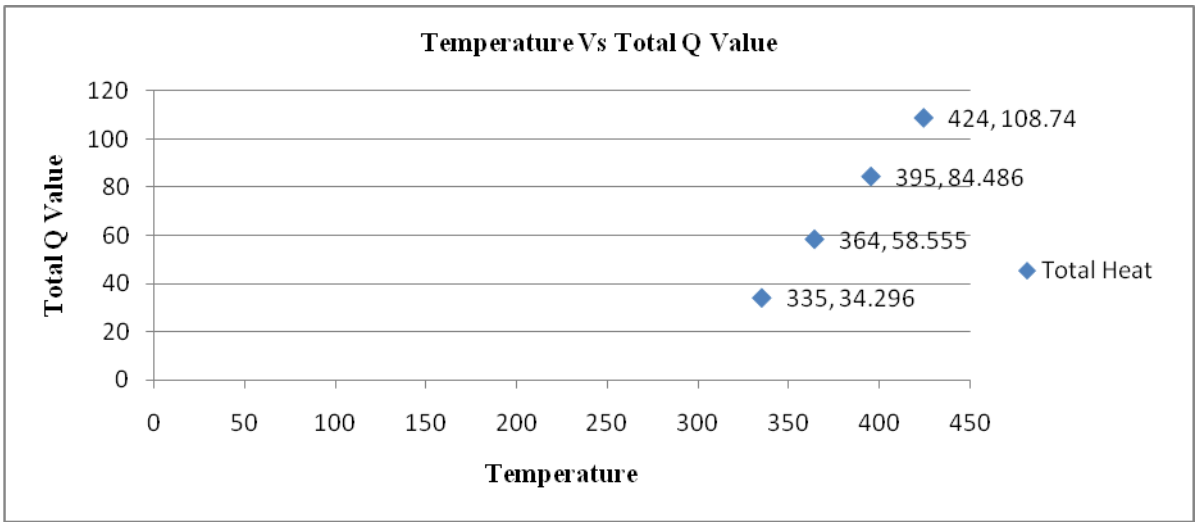
Fig No: 3d

t = 424K

Nodal Solutions for Steady State Temperature Distribution in Case of Silica Aero-Gel Material



Graph No: 1 Relations B/w Temperature & Total Q Value (Material is Aero – Gel)



Graph No: 2 Relations B/w Temperature & Total Q Value (Material is Diamond)

III. CONCLUSIONS

1. Thermal conductivity of metals is high as compared with non-metals, but Diamond is a non-metal and has the highest thermal conductivity than metals. Since, structure of Diamond is macro-molecule that is there are many atoms which have strong covalent bond in between them. As a result, it requires a lot of heat to break the inter-molecular force between them.
2. In non-metals expect diamond all has least thermal conductivity, among non-metals Silica Aero-Gel has the least thermal conductivity of 0.024 W/m K. Due to its least thermal conductivity of silica aero-gel, it works as a best insulator.
3. In non-metals also the rate of heat transfer decreases from non-metals having high thermal conductivity to the non-metals having least thermal conductivity. From Diamond (C) Silica Aero-Gel, the fall in rate of heat transfer at temperature 335K is 68.593 W to 1.33744 W respectively.
4. As observed that, compared to metals the rate of heat transfer is not decreasing gradually for the above considered non-metals. Because of the highest thermal conductivity of diamond there is a large variation in heat transfer rate of diamond and silica aero-gel.

REFERENCES

[1] H. Yamaguchi, M.T. Ho, Y. Matsuda, T. Niimi, I. Graur, Conductive heat transfer in a gas confined between two concentric spheres: From free-molecular to continuum flow regime, Int. J. Heat Mass Transf. 108 (2017) 1527-1534.

[2] Wayne M. Trott, Jaime N. Castaneda, John R. Torczynski, Michael A. Gallis, Danuel J. Rader, An experimental assembly for precise measurement of thermal Accommodation coefficients, Rev. Sci. Instrum. 82 (2011) 0355120.

[3] Hiroki Yamaguchi, Yakamas Imai, Tadashi Iwai, Akira Kondo, Yu Matsuda, Tom hide Nimbi, Measurement of thermal accommodation coefficients using a simplified system in a concentric sphere shells configuration, J. Vac. Sci. Technol. A 32 (6) (2014) 061602.

[4] M.T. Ho, I. Graur, Heat transfer through rarefied gas confined between two concentric spheres, Int. J. Heat Mass Transf. 90 (2015) 58-71.

[5] A.H. Ali Al-Fouadi, O.R. Ali Al-Rubaye, Mechanical and Thermal Properties of Copper Cordierite Ceramic Matrix Composites, Int. J. Application or Innovation in Engineering and management (IJAIEM), Vol. 3, Issue 12 (Dec. 2014) ISSN 2319-4847.

[6] Nam-Hoon, Dong-Myong Na, Pil-Ju Ko, Jin-Seong Park, Woo-Sun Lee, Electrical and thermal properties of platinum thin films prepared by DC magnetron sputtering for micro-heater of micro sensor application after CMP process, Trans. Tech., Switzerland, Vol. 124-126 (2007) pp. 267-270.

[7] Peter Hidnert, Thermal expansion of titanium, J. Research of the national bureau of standards, Vol. 30 (Feb 1943) 101-105.

[8] Ehsan Rezaei, Jafarsadegh Moghaddas, Thermal conductivities of silica aerogel composite insulating material, Adv. Mater. Lett. 7 (4) (2016) 296-301.

[9] G.S. Springer, Heat transfer in rarefied gases, in: T.F. Irvine, J.P. Harnett (Eds.), Advanced in Heat Transfer, Academic, New York, 1971, pp. 163-218.

[10] H. Yamaguchi, K. Kanazawa, Y. Matsuda, T. Niimi, A. Polikarpov, I. Graur, Investigation on heat transfer between two coaxial cylinders for measurement of thermal accommodation coefficient, Phys. Fluids 24 (2012) 062002.

[11] I. Amdur, L.A. Guildner, Thermal accommodation coefficients on gas-covered tungsten, nickel and platinum, J. Am. Chem. Soc. 79 (2) (1957) 311-315.

[12] L.B. Thomas, F. Olmer, The accommodation coefficients of He, Ne, A, H_2, D_2, O_2, CO_2, and Hg on platinum as a function of temperature, J. Am. Chem. Soc. 65 (6) (1943) 1036-1043.