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Comparison of Thermal Characteristics of Simple Boiler with Circulating Fluidized Bed (CFB) Boiler using Thermal Analysis

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Abstract - In this paper, a simple boiler and a CFB boiler are compared for the better thermal characteristics. In general the material used for boiler is steel. But we are replaced with copper and brass. Thermal analysis is done to verify the better heat transfer rate by comparing simple boiler and CFB boilers and to know which better materials in the copper and brass. The 3D modeling of simple boiler and CFB boiler are drawn in Pro/Engineer and thermal analysis is done in Ansys to obtain total temperature and het flux for both boilers with both materials.

Key words: Simple Boiler, CFB Boiler, Temperature, Heat flux, Steel, Copper, Brass, Thermal Analysis etc.

I. INTRODUCTION

Supercritical Circulating Fluidized Bed (CFB) boiler becomes an important development trend for coal-fired power plant and thermal-hydraulic analysis is a key factor for the design and operation of water wall. According to the boiler structure and furnace-sided heat flux, the water wall system of a 600 MW supercritical CFB boiler is treated in this thesis as a flow network consisting of series-parallel loops, pressure grids and connecting tubes. A boiler is a closed vessel in which water or other fluid is heated. The fluid does not necessarily boil. The heated or vaporized fluid exits the boiler for use in various processes or heating applications, including central heating, boiler-based power generation, cooking, and sanitation.

II. LITERATURE SURVEY

Ilkka Venäläinen, Rafał Psik have worked onCirculating fluidized bed (CFB) boiler technology has been growing in size and number over the past two decades and it has established its position as utility scale boiler technology. Plant sizes up to 300 MWe are in operation today and designs for larger boilers are being developed. The next natural step for CFB technology is to go for supercritical steam parameters and larger boiler sizes. A Polish utility company Południowy Koncern Energetyczny SA (PKE) placed an order to Foster Wheeler Energia Oy for a 460 MWe supercritical CFB boiler for their Łagisza power plant. Contract was signed at the end of year 2002 and the engineering work is now ongoing. This will be the first supercritical once through CFB boiler in the world.

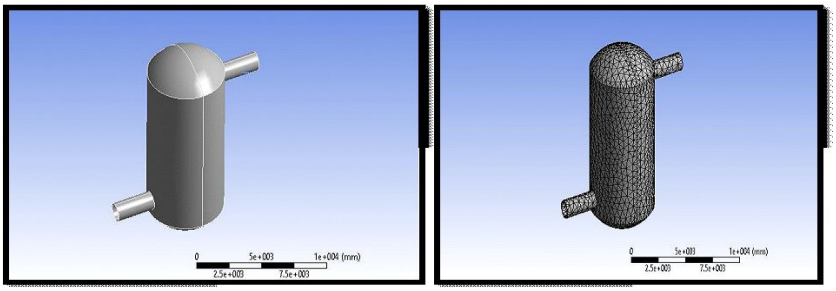
Ragnar Lundqvist, Andre Schrief, Pertti Kinnunen, Kari Myöhänen, Mani Seshamani focused their work on Having built the Rivesville demonstration unit and the world's largest CFB boilers, Foster Wheeler has been a pioneer in this effort. The largest units now in operation, with a nominal 300 MWe capacity, are located at Jacksonville Electric Authority's Northside Generating Station These began operation in 2002 and can fire coal or petroleum coke in varying proportions.

Stephen J. Goidich and David E. Wagner presented their work in the application of supercritical technology and boiler design to the proven combustion methods of Arch Fired Pulverized Coal and Circulating Fluid Bed for boiler sizes exceeding 600 MWe. The ability to successfully burn these low volatile fuels in an efficient manner, and within emission control standards is of critical importance to the future growth of the Chinese power generation industry.

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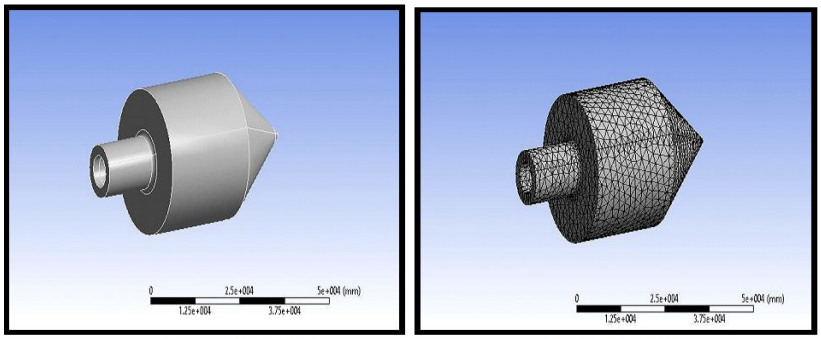
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III. THERMAL ANALYSIS



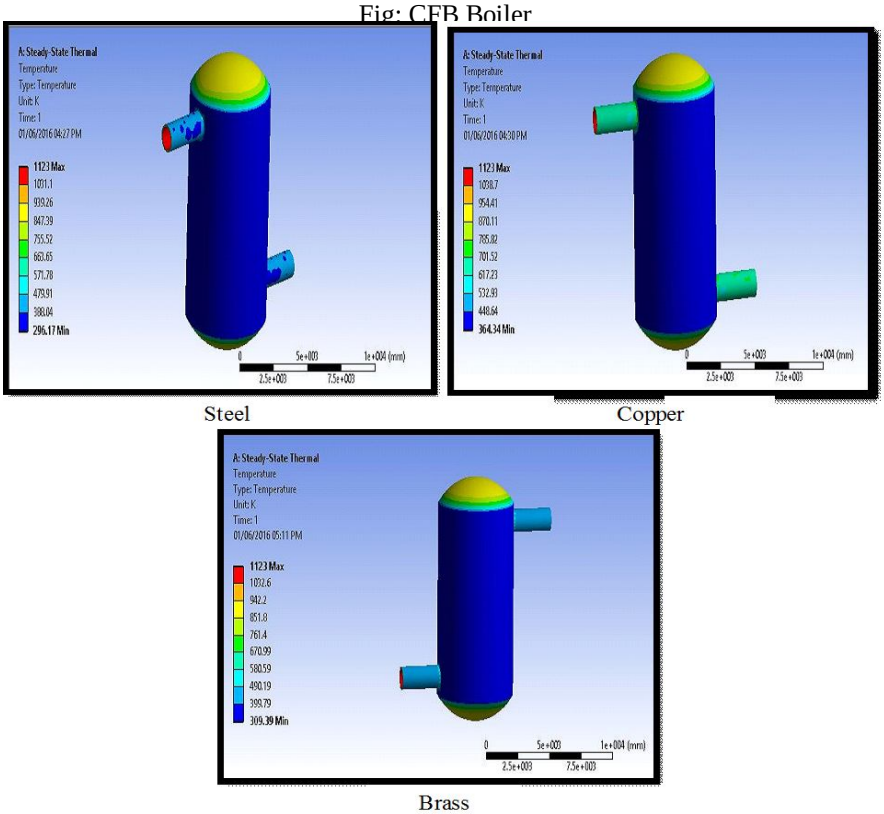
Imported model Meshed Model

Fig: Simple Boiler



Imported Model **Meshed Model**

Fig: CFB Boiler



Steel Copper

Brass

Fig: Temperature distribution of Simple boiler at different materials

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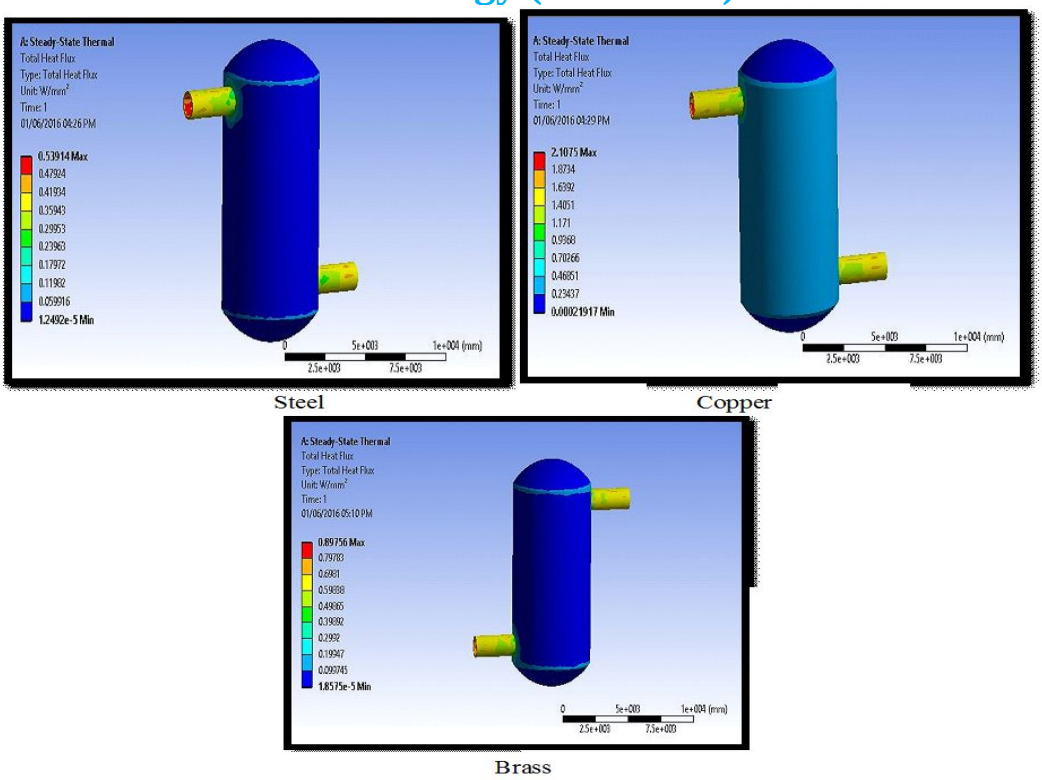


Fig: Heat Flux values of simple boiler at different materials

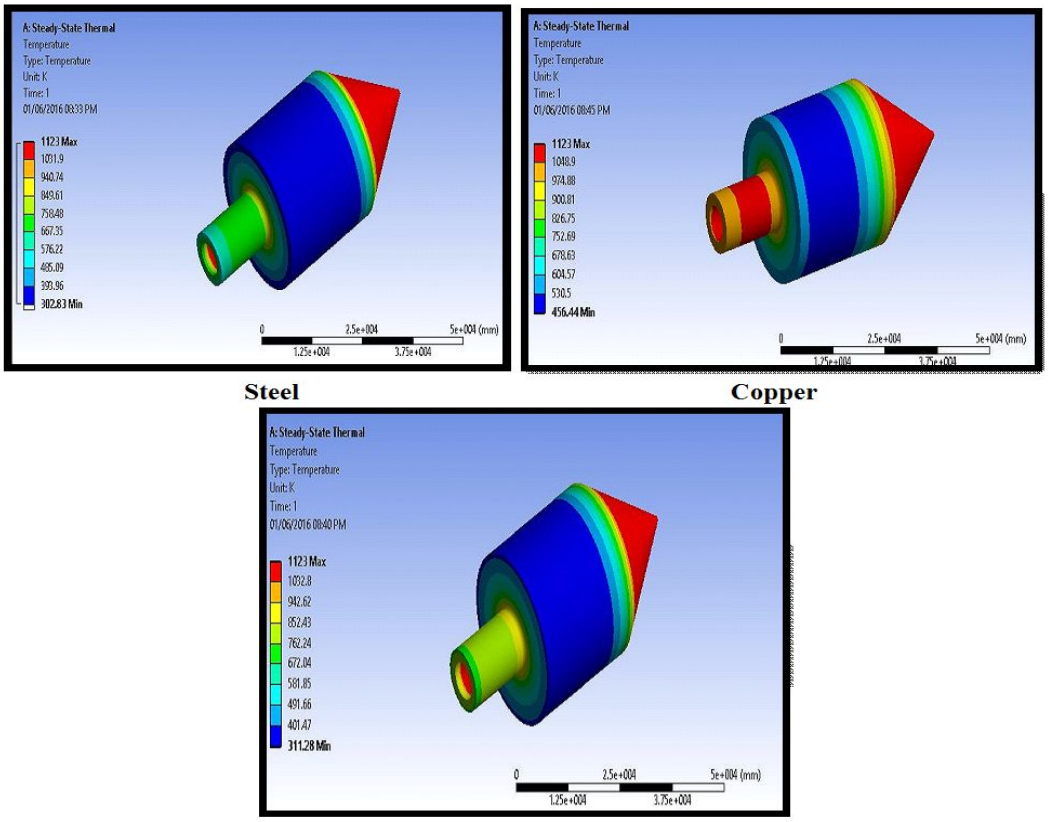


Fig: Temperature distribution of CFB boiler at different materials

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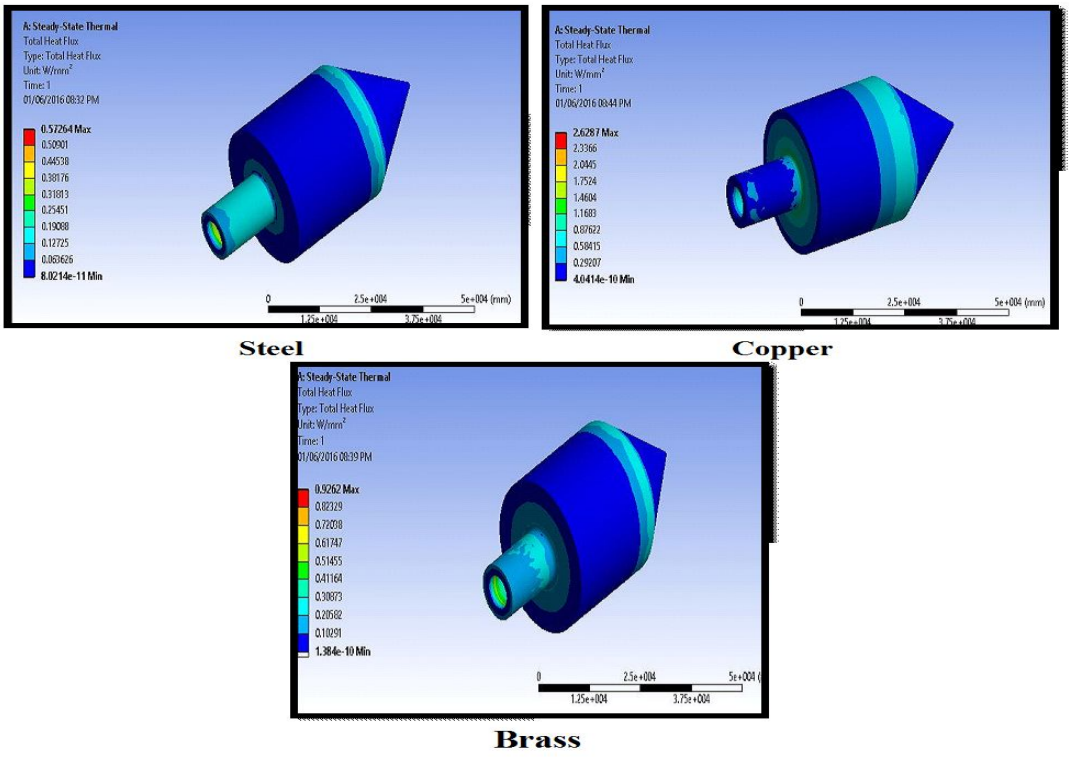


Fig: Heat flux values of CFB Boiler at various materials

IV. RESULTS AND DISCUSSIONS

TABLE: THERMAL ANALYSIS RESULTS

Type of Boiler	Materials	Temperature (K)		Heat flux (w/mm^2)
		Max	Min	
Simple boiler	Steel	1123	296.17	0.53914
	Copper	1123	364.34	2.1075
	Brass	1123	309.39	0.8975
CFB boiler	Steel	1123	302.83	0.5726
	Copper	1123	456.44	2.6257
	Brass	1123	311.25	0.9262

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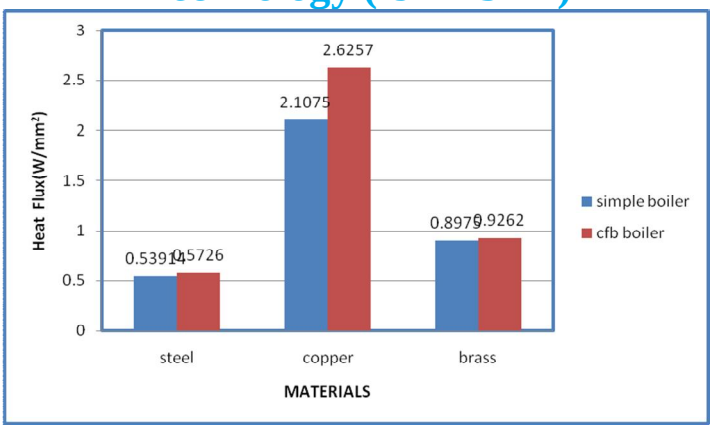


Fig : comparison of heat flux values for simple and CFB boiler and different materials

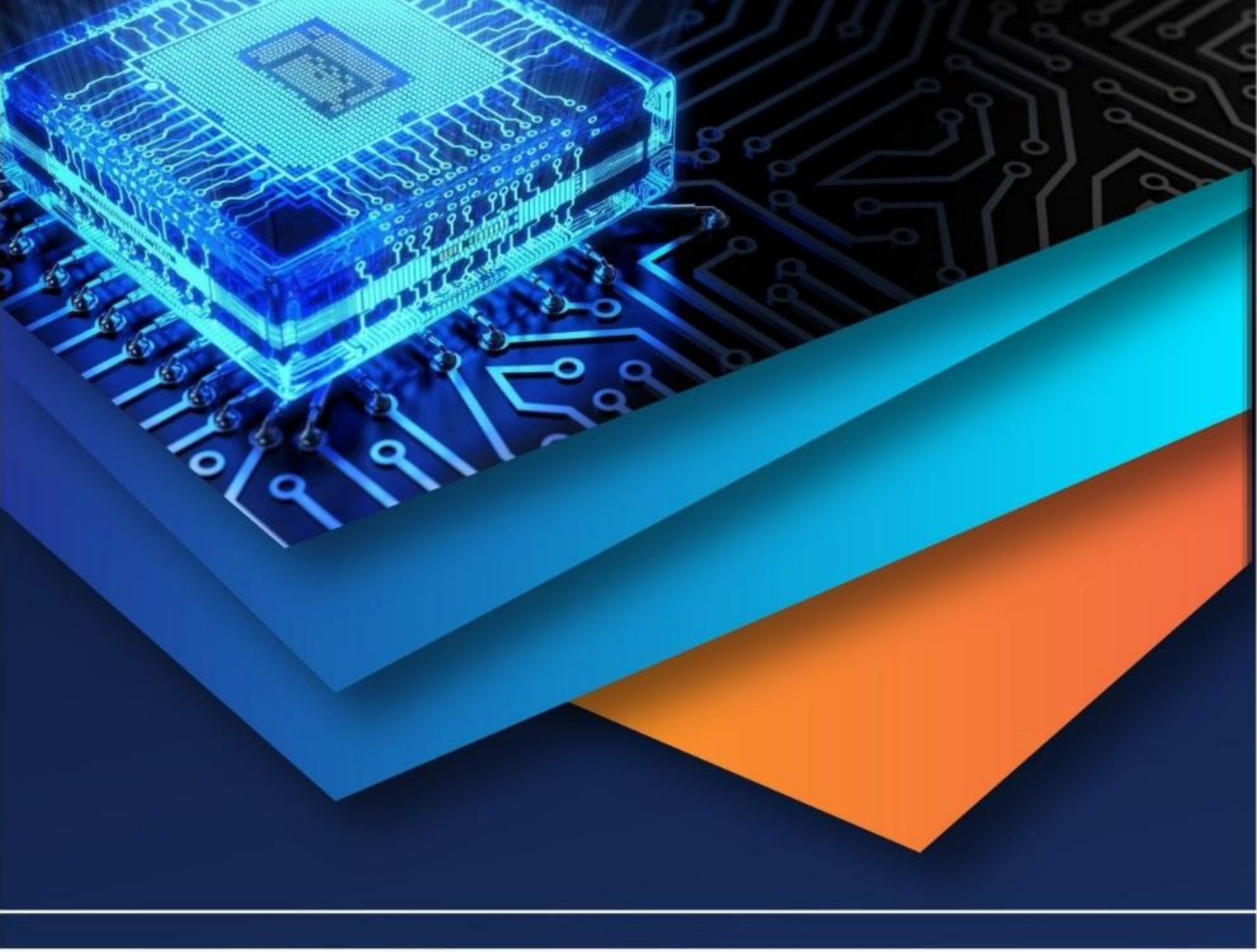
V. CONCLUSION

By observing the thermal analysis results the minimum temperature of the simple boiler and CFB boiler is more for copper material comparing to steel and brass boilers. And also the heat flux is more for copper material comparing to steel and brass boilers in both simple and CFB Boilers. It is noticed that comparing to simple boiler the minimum temperature and heat flux values are more in CFB boiler at all types of materials like steel, copper and brass. So it can be concluded that CFB boiler have better performance and better thermal characteristics comparing to simple boiler. And copper is best suitable material out of these three materials for both simple boilers and CFB boilers.

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