ANALYTICAL VALIDATION FOR FINDING THE BEST PERFORMANCE OF C.I ENGINE PISTON HAVING COATED AND NON-COATED ALLOY MATERIALS

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Abstract: Two stroke motors have disadvantage of more fuel utilization and more fumes outflow, as contrasted and four stroke motors. Level of discharge is more in two stroke motors. Decreases in fuel utilization can be accomplished by an assortment of measures, including Improved Aerodynamics, Weight Reductions and Hybrid Power Trains. Huge changes have been made to enhance proficiency of the IC Engine that forces about all the world's vehicles. One of the promising innovations for enhancing CI Engine effectiveness, and in addition execution and solidness is piston coatings. In this investigation the execution of the motor is considered previously, then after the fact the use of covering on the piston crown.
Keywords: CI engines, piston coatings.

Introduction:

Over the most recent two decades, numerous scientists have contemplated that biodiesel energizes deliver no sulfur dioxide and less sweet-smelling hydrocarbon emanations. They are inexhaustible, less dangerous, and biodegradable and their ignition attributes are similar with oil diesel powers [1-3]. Notwithstanding that the biodiesel properties are like that of oil diesel energizes and they can be utilized as sole fuel or mixed with diesel in diesel motors with no change [4, 5]. The utilization of crude vegetable oils utilized as fuel for diesel motors without makes some picture parts of the motor and furthermore, the execution is incredibly influenced [6,7]. Different analysts have directed trials to ponder the execution and emanation qualities of diesel motor when vegetable oils, mixes of vegetable oil and its subordinates are utilized as fuel.

The performance tests using blends of diesel and Jatropha oil in a single-cylinder CI engine. The results showed that specific fuel consumption and the exhaust gas temperature were reduced to decrease in viscosity of the vegetable oil. Therefore, the main objective of the present study is to decrease the viscosity of jatropha curcas oil by blending with diesel and to evaluate the engine performance and emission characteristics without any substantial hardware. [8]

Objectives:

1. To know the preparation of C.I ENGINE PISTON.
2. To study the applications of C.I ENGINE PISTON.
3. To understand the properties such as mechanical, electrical and thermal properties of coated and Non-Coated alloys.
4. To study the usage of coated and Non-Coated alloys

Literature review:

Dr S. L. V. Prasad et al. 2013 investigate the technique to enhance the air swirl to achieve betterment in engine performance and emission in a direct injection (DI) single cylinder diesel engine. In order to achieve the different swirl intensities in the cylinder, three design parameters have been selected: the cylinder head, piston crown, and inlet manifold. In order to research the intensification of swirl in the piston

M. Peeraiah M. Chandra Sekhar Reddy (1999) series of experiments are conducted by making straight grooves in the cylinder head. In this work three different configurations of cylinder heads i.e. in the order of number of grooves 1, 3, 6 are used to intensify the swirl for better mixing of fuel and air and to enhance the performance of the engine. An attempt is made in this work with different number of channels on the cylinder head of the diesel engine. A number of channels of size 16x3x2 mm are arranged on the cylinder head depends on the locally available technology.

B.V.V.S.U.Prasad et al. 2010 concerns the effect of swirl induced by re-entrant piston bowl geometries on emissions in a diesel engine, and specifically focuses on a single cylinder, 7.5 kW constant-speed engine. The emission test results of two configurations of the selected engine are reported. The second configuration which has a slight lyreentrant combustion chamber and a sac-less injector was found to yield lower emissions. In order to understand the effect of re-entrance and injector change on emissions, detailed, three- simulations of the in-cylinder processes were conducted. The effect of chamber geometry and injector change was studied using unfired and fired simulations. Simulation of closed valve part of the cycle in the two configurations revealed that average swirl and turbulence levels around TDC of compression were higher for the baseline case than for the modified geometry

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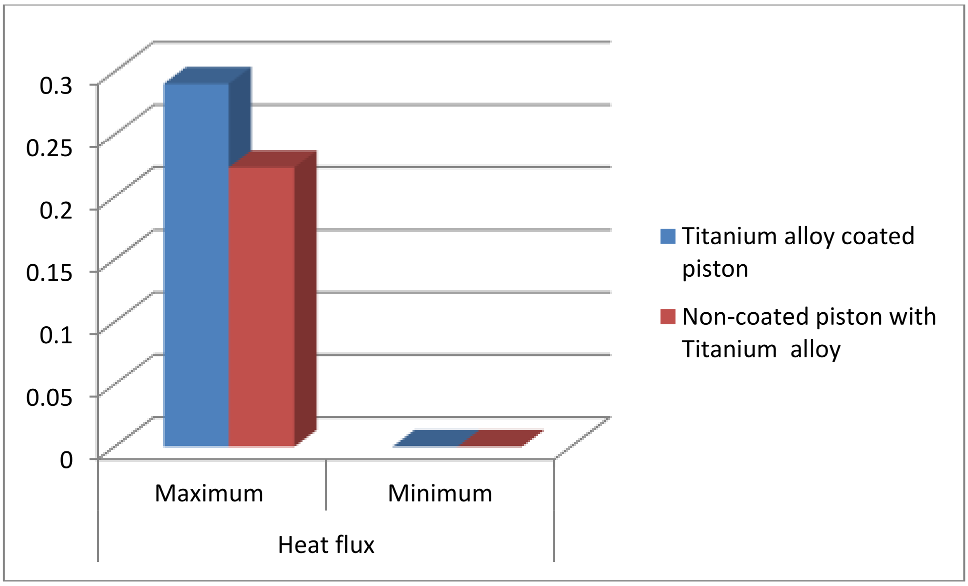
Vaibhav Bhatt et al 2014 investigated combustion efficiency of CI Engine can be increased by creating turbulence, by designing intake system, by designing combustion chamber. A good swirl promotes fast combustion to improve the efficiency. So in this present work a study about influence of air swirl in the combustion chamber upon the performance and emission of a diesel engine is presented. In order to achieve different swirl intensity to improve combustibility of combustible mixture in the cylinder, three different configurations of piston i.e. in the order of number of grooves 4, 8 and 12 are used to intensify the swirl for the better mixing of fuel and air and their effect on the performance and emissions

Materials and methods for analytical validation:

TABLE 1 HEAT FLUX FOR TITANIUM ALLOY COATED AND NON COATED MATERIALS ON PISTION

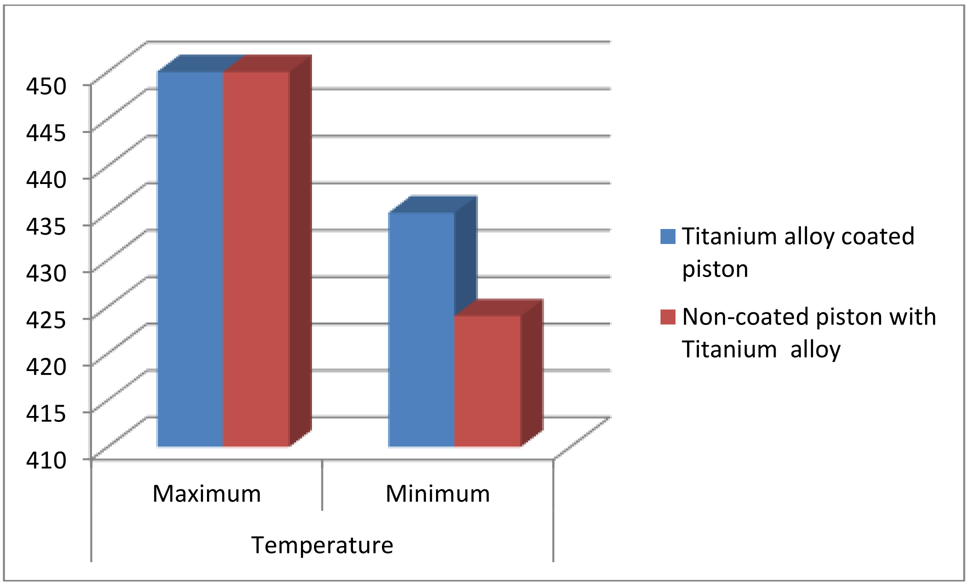
Materials	Heat flux	
	Maximum	Minimum
Titanium alloy coated piston	0.2904	7.536E-6
Non-coated piston with Titanium alloy	0.22333	1.0563e-7



GRAPH 1 COMPARISION OF HEAT FLUX VARIATIONS FOR TITANIUM ALLOY COATED AND NON COATED MATERIALS ON PISTION

TABLE 2 TEMERATURE FOR NIMONIC ALLOY COATED AND NON COATED MATERIALS ON PISTION

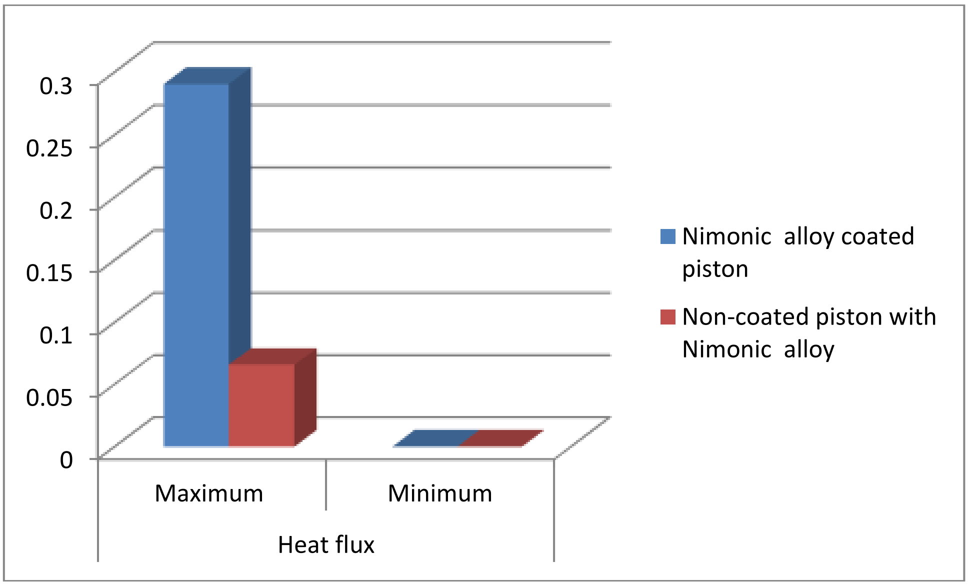
Materials	Temperature	
	Maximum	Minimum
Titanium alloy coated piston	450	435.03
Non-coated piston with Titanium alloy	450	424.01



GRAPH 2 COMPARISION OF TEMPERATURE VARIATIONS FOR COPPER ALLOY COATED AND NON COATED MATERIALS ON PISTION

TABLE 3 HEAT FLUX FOR NIMONIC ALLOY COATED AND NON COATED MATERIALS ON PISTION

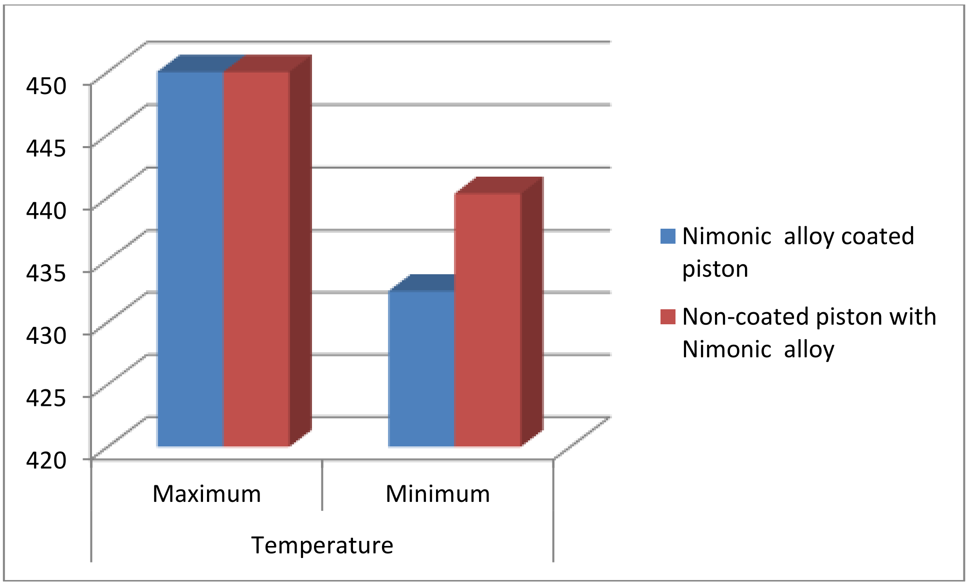
Materials	Heat flux	
	Maximum	Minimum
Nimonic alloy coated piston	0.086763	7.7115e-6
Non-coated piston with Nimonic alloy	0.065778	1.0065e-7



GRAPH 3 COMPARISION OF HEAT FLUX VARIATIONS FOR NIMONIC ALLOY COATED AND NON COATED MATERIALS ON PISTION

TABLE 4 TEMPERATURES FOR COPPER ALLOY COATED AND NON COATED MATERIALS ON PISTION

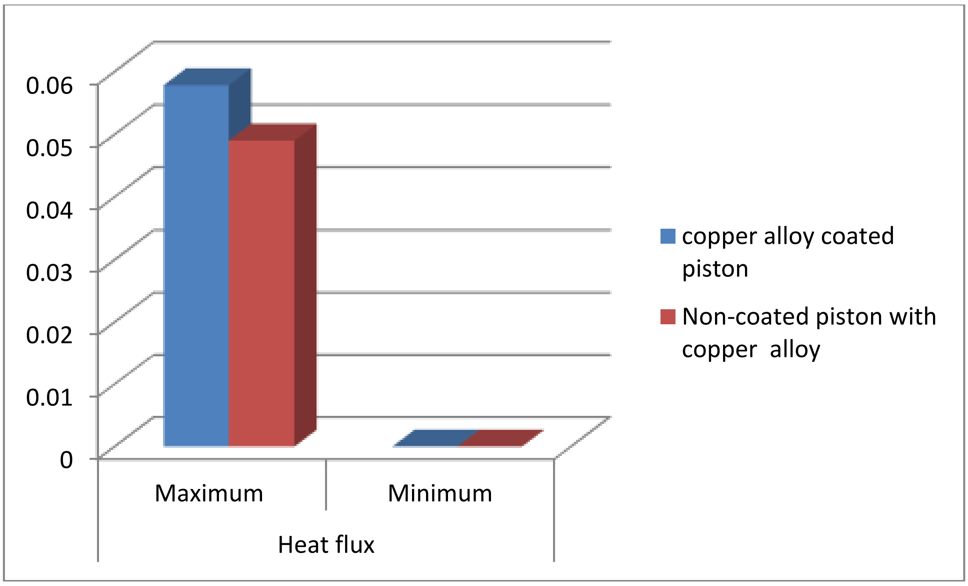
Materials	Temperature	
	Maximum	Minimum
Nimonic alloy coated piston	450	432.48
Non-coated piston with Nimonic alloy	450	440.31



GRAPH 4 COMPARISION OF TEMPERATURE VARIATIONS FOR NIMONIC ALLOY COATED AND NON COATED MATERIALS ON PISTION

TABLE 5 HEAT FLUX FOR COPPER ALLOY COATED AND NON COATED MATERIALS ON PISTION

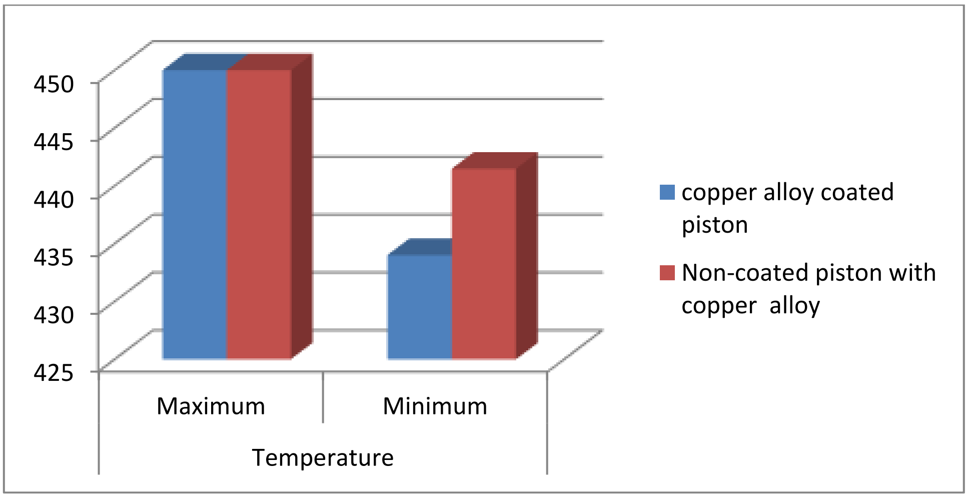
Materials	Heat flux	
	Maximum	Minimum
copper alloy coated piston	0.057837	7.0428e-6
Non-coated piston with copper alloy	0.049025	9.8654e-8



GRAPH 5 COMPARISION OF HEAT VARIATIONS FOR COPPER ALLOY COATED AND NON COATED MATERIALS ON PISTION

TABLE 6 TEMPERATURES FOR COPPER ALLOY COATED AND NON COATED MATERIALS ON PISTION

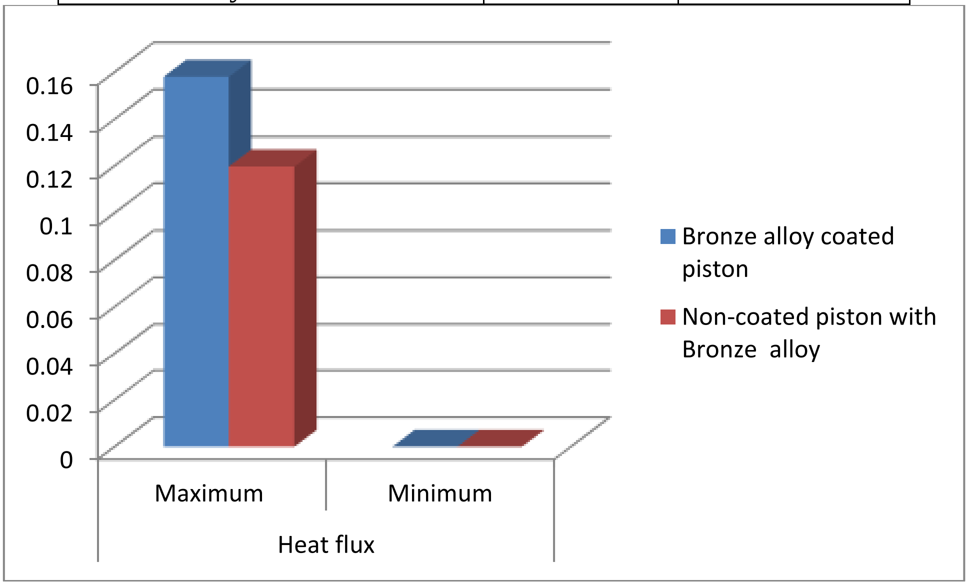
Materials	Temperature	
	Maximum	Minimum
copper alloy coated piston	450	434.01
Non-coated piston with copper alloy	450	441.47



GRAPH 6 COMPARISION OF TEMPERATURE VARIATIONS FOR COPPER ALLOY COATED AND NON COATED MATERIALS ON PISTION

TABLE 7 HEAT FLUX FOR BRONZE ALLOY COATED AND NON COATED ON PISTION

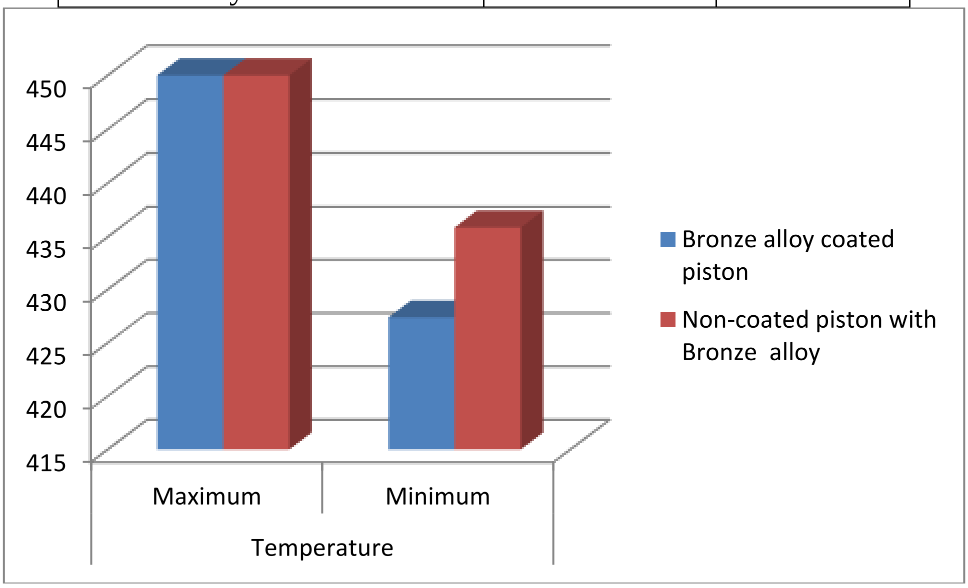
Materials	Heat flux	
	Maximum	Minimum
Bronze alloy coated piston	0.15799	4.5087e-6
Non-coated piston with Bronze alloy	0.11968	1.0379e-7



GRAPH 7 COMPARISION OF HEAT FLUX VARIATIONS FOR BRONZE ALLOY COATED AND NON COATED ON PISTION

TABLE 8 TEMPERATURES FOR BRONZE ALLOY COATED AND NON COATED ON PISTION

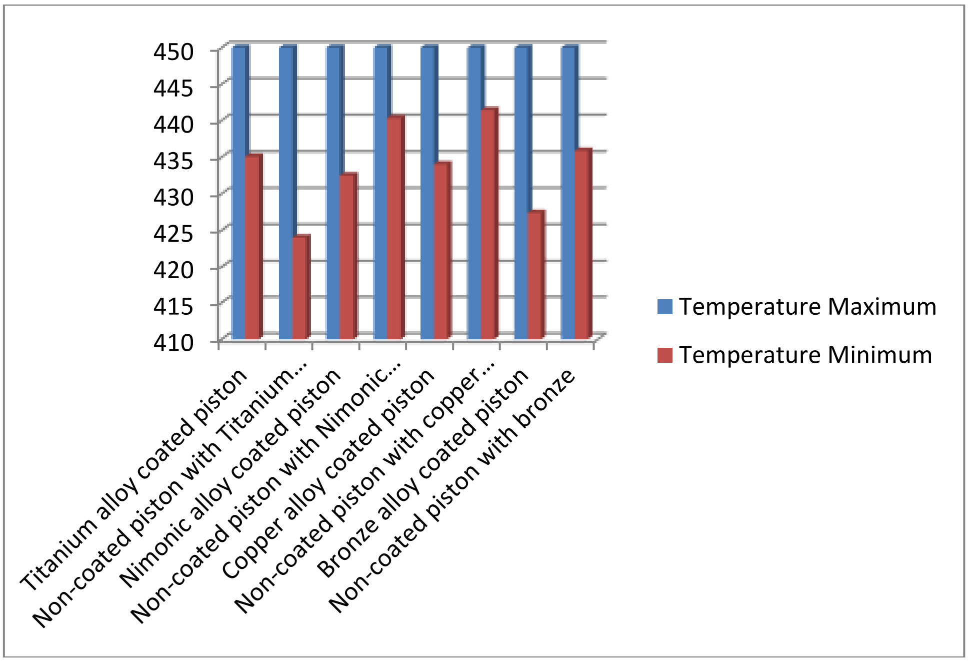
Materials	Temperature	
	Maximum	Minimum
Bronze alloy coated piston	450	427.38
Non-coated piston with Bronze alloy	450	435.87



GRAPH 8 COMPARISION OF TEMPERATURE VARIATIONS FOR BRONZE ALLOY COATED AND NON COATED ON PISTION

TABLE 9 TEMPERATURES FOR ALL COATED AND NON COATED ALLOY MATERIALS ON PISTION

Materials	Temperature	
	Maximum	Minimum
Titanium alloy coated piston	450	435.03
Non-coated piston with Titanium alloy	450	424.01
Nimonic alloy coated piston	450	432.48
Non-coated piston with Nimonic alloy	450	440.31
Copper alloy coated piston	450	434.01
Non-coated piston with copper alloy	450	441.47
Bronze alloy coated piston	450	427.38
Non-coated piston with bronze	450	435.87



GRAPH 9 CAMPARISION OF TEMPERATURE VARIATIONS FOR ALL COATED AND NON COATED ALLOY MATERIALS ON PISTION

TABLE 10 HEAT FLUX FOR ALL COATED AND NON COATED ALLOY MATERIALS ON PISTION

Materials	Heat flux	
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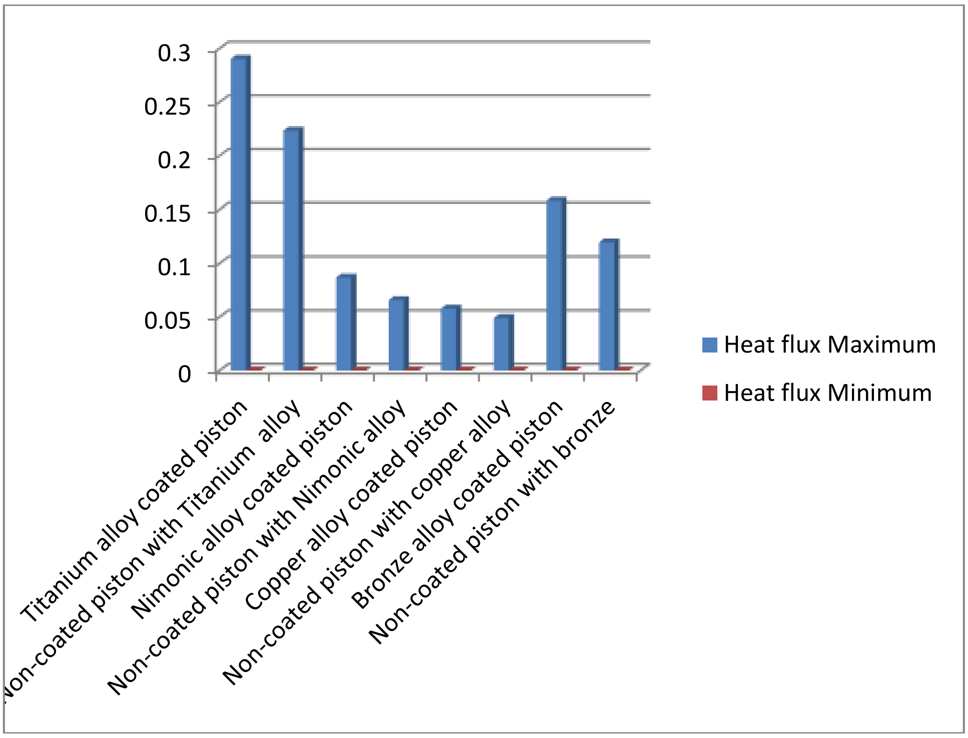
Non-coated piston with copper alloy	0.049025	9.8654e-8
Bronze alloy coated piston	0.15799	4.5087e-6
Non-coated piston with bronze	0.11968	1.0379e-7



GRAPH 10 CAMPARISION OF HEAT FLUX VARIATIONS FOR ALL COATED AND NON COATED ALLOY MATERIALS ON PISTION

Conclusions:

There is percentage increase in brake specific fuel consumption, brake thermal efficiency, mass of fuel consumed for different speeds and loads as-

1) Temperature change in piston using Titanium material without coating & coating of an average of = 450^0c
2) Heat flux change in piston using Titanium material without coating & coating of an average of = 0.25685 **W/m2**
3) Temperature change in piston using Nimonic material without coating & coating of an average of = 450^0c
4) Heat flux change in piston using Nimonic material without coating & coating of an average of = 0.07627 **W/m2**
5) Temperature change in piston using copper material without coating & coating of an average of = 450^0c
6) Heat flux change in piston using copper material without coating & coating of an average of = 0.05343 **W/m2**
7) Temperature change in piston using bronze material without coating & coating of an average of = 450^0c
8) Heat flux change in piston using bronze material without coating & coating of an average of = 0.13883 **W/m2**

The performance of an externally scavenged engine will be improved with titanium and bronze Piston Coating, as compared to normal piston & Nimonic and copper coating. Therefore Ti, Br Piston Coating is an effective method to enhance performance of two strokes CI Engine. The engine with TBC piston helps in increasing the power of the engine as stated above. This is because complete combustion of the charge in the combustion chamber which leads to minimization of emission of carbon & hydrocarbon in the exhaust gases.

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