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Implementation of CNCCSas a Nozzle Throat Coater to Generate Optimum ofthe Rocket Thrust

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Abstract:- The purpose of this study was to prove the effect of coconut shell nano carbon as a coating for the throat nozzle in order to obtain optimal rocket thrust resistance to thermal temperatures up to 2500^{0}C or able to withstand compression or exhaust gas pressure in the throat nozzle up to 80 Kg/cm^2. The method used is by comparing experimentally with 3 samples of chamber material, namely the combustion of propellant in the chamber using a nozzle throat diameter of 5mm2 without coconut shell carbon nano coating (NCNCCS), throat nozzle using non-coconut carbon nano coating (CNCNCS), and nozzle throat using coconut shell nanocarbon coating (CNCCS). The results from testing the three samples, the nozzle throat using CNCCS can withstand gas pressure up to 80 Kg/cm^2, while NCNCCS with stands gas pressure compression of 60 Kg/cm^2, CNCNCS withstands gas pressure compression of 71 Kg/cm^2. Comparison of nozzle throat using CNCCS produces the most optimal thrust compared to using NCNCCS and CNCNCS.

Keywords:-*Nozzle Throat, Gas Pressure, Thrust, CNCCS.*

I. INTRODUCTION

A rocket is a type of propulsion system that works based on the application of Newton's third law and conservation of momentum by emitting a mass flow from the combustion of propellants. The propellant from the rocket is burned in the combustion chamber to produce gas pressure and then exhausted through the nozzle located behind the rocket. The result is that the gas pressure is sprayed resulting in a thrust force in the opposite direction so as to push the rocket body [1,3].

The propulsion system generates a thrust force, which is the force that moves the rocket through air and space. Different propulsion systems produce thrust in different ways, but always through some application of Newton's third law of motion. In any propulsion system, the working fluid is accelerated and the reaction to this acceleration produces a force on the system. The amount of thrust generated depends on the mass flow of propellant combustion out of the nozzle and the pressure of the gas that comes out [2].

Propellant is a mixture of the composition between fuel and oxidizer if burned will produce a rocket thrust. Fuel is a substance that burns when combined with oxygen-producing gases for propulsion. Oxidizing agents are substances that release oxygen for combustion with fuel. The oxidizing ratio of the fuel is called the mixture ratio and in this case it is 65/35 according to Nakka. Thrust is the force used to propel a rocket and is measured in newtons.The total increase is found by adding up all the measured values from the theme and multiplying by the increase in time. [4].

II. MATERIALSANDMETHODS

A. Materials

The chamber material has a length of 30 cm and an outer diameter of 3.5 cm. Chamber is a place for rocket propellant in the form of a tube, as shown in Figure 1 test chamber

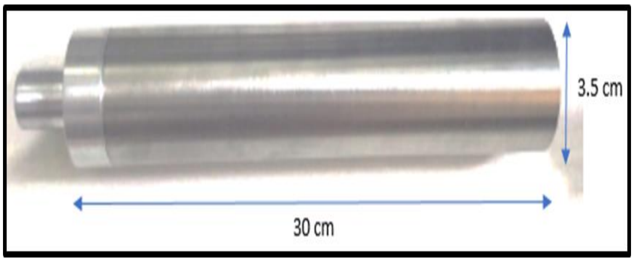

Fig1**:-**Chamber

There are 3 types of nozzle throat used, namely the nozzle throat diameter of 5mm2 without coconut shell carbon nano coating (NCNCCS), throat nozzle using non-coconut carbon nano coating (CNCNCS), and nozzle throat using coconut shell nanocarbon coating (CNCCS). As shown in figure 2 nozzle throat.

Fig2**:-**Nozzle Throat NCNCCS, CNCNCS,CNCCS

B. Methods

The research method uses experiment and the optimal results are selected. Comparing 3 types of nozzle throat NCNCCS (throat that is not coated), CNCNCS (throat that is coated with carbon instead of coconut shell nano carbon), CNCCS (throat that is coated with coconut shell nano carbon). Nozzle throat is installed in the chamber and in the chamber tube is filled with a composite solid propellant consisting of a mixture of ammonium perchlorate, aluminum, HTPB. The size of the solid propellant is 30cm long and 3cm in diameter. Mass of propellant 100 grams. After that, each type is tested for combustion and the resulting temperature, gas pressure and thrust values are measured. Furthermore, the test results of the three types are compared to find the most optimal thrust value.

III. RESULT

As shown in table 1. the nozzle throat test was carried out 9 times, divided into 3 types of tests, namely three times temperature test, three gas pressure test, three thrust test. The results of the nozzle throat test show that the NCNCCS throat material is able to withstand the influence of an average temperature of 1900^{0}C, gas pressure of 60Kg / cm2, thrust 400N CNCNCS is able to withstand the effects of an average temperature of 2200^{0}C, gas pressure of 71 Kg / cm2, thrust of 600N CNCCS is capable of withstand the influence of an average temperature of 2500^{0}C, gas pressure 80Kg / cm2, trhust 800N.

Temperature Tes (^{0}C)	**NCNCCS**	**CNCNCS**	**CNCCS**
1.	1906	2205	2503
2.	1900	2200	2500
3.	1894	2195	2497
Gas Pressure Tes (Kg/cm^2)	NCNCCS	CNCNCS	CNCCS
1.	63	72	80.5
2.	60	71	80
3.	57	70	79.5
Thrust Tes (N)	NCNCCS	CNCNCS	CNCCS
1.	405	603	801
2.	400	600	800
3.	395	597	799

Table 1.Temperature Tes, Gas Pressure Tes, Thrust Tes

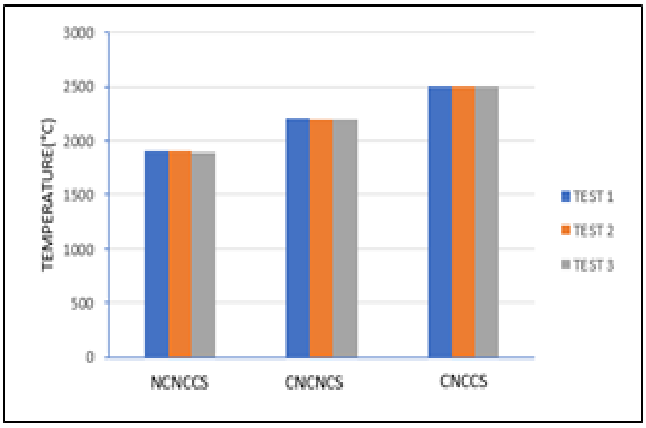

Fig 3. Comparison of Temperature

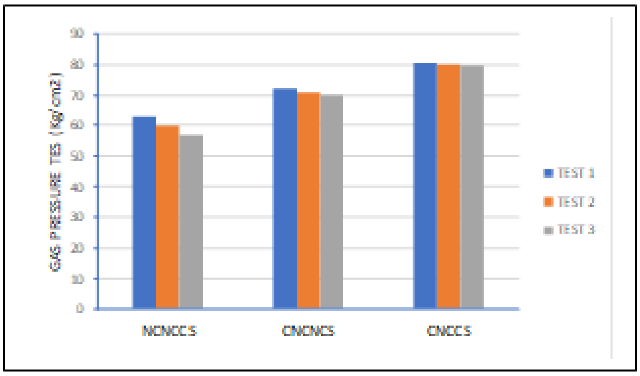

Fig 4. Comparison of Gas Pressure

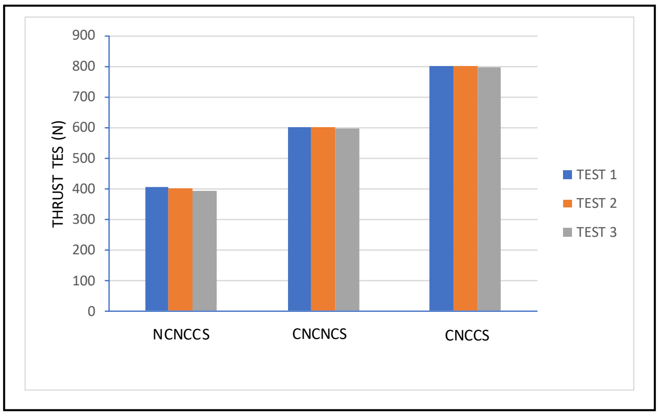

Fig 5. Comparison of Thrust

IV. RESULT AND ANALISYS

As shown in Figure 3 the temperature comparisons generated from NCNCCS, CNCNCS, and CNCCS show that the nozzle throat material coated with coconut shell nano carbon or CNCCS is the strongest to withstand heat, which is at an average temperature of 2500^{0}C .

As shown in Table 1, a drastic change in the temperature value occurs in the nozzle throat material NCNCCS This shows the level of abrasion due to the influence of temperature on the material is very large. This shows the level of abrasion due to the influence of temperature on the material is very large. This condition accelerates the exit gas pressure and the rocket thrust becomes weak.

Meanwhile, when using CNCNCS coating material, the nozzle throat is more resistant to high temperatures up to an average of 2000^{0}C and the change in temperature resistance is relatively smaller than NCNCCS.The most optimal condition for holding heat is when the nozzle throat material uses CNCCS, because it can withstand heat up to 2500^{0}C and a relatively small change in abrasion temperature compared to others.

The ability to withstand gas pressure in NCNCCS materials is relatively the weakest compared to CNCNCS and CNCCS, because of the significant changes in gas temperature and pressure.

The ability to withstand gas pressure in NCNCCS materials is relatively the weakest compared to CNCNCS and CNCCS, because of the significant changes in gas temperature and pressure. The ability to withstand the highest gas pressure is proven by CNCCS which is able to withstand gas pressures reaching 80 Kg / cm2. Overall the ability of the nozzle throat material to withstand gas temperature and pressure has a significant effect on the resulting thrust parameter. From the trials of the three nozzle throat materials, it was proven that NCNCCS had the weakest thrust of 400N, CNCNCS produced 600N, and CNCCS produced the most optimal thrust of 800N.

V. CONCLUSION

From the experiments that have been carried out, it can be concluded that the NCNCCS nozzle throat material shows the worst performance because it is only able to withstand an average thermal of 1600^0C, CNCNCS pressure, gas pressure of 60Kg / cm2, and the resulting thrust of 400N. CNCNCS is relatively better than NCNCCS which is able to withstand an average thermal of 2200^0C, gas pressure of 71 Kg / cm2, and produces thrust of 600N. The most optimal conditions are shown by CNCCS, which is able to withstand an average thermal of 2500^0C, gas pressure of 80 Kg / cm2, and produce thrust of 800N.

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