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Use of MHD Technology to Generate Electrical Power

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A B S T R A C T

MHD is a new technique to generate electrical power In MHD system combustor, electrodes and air preheated are exposed to corrosive in all combustion gases at very high temperatures before materials must be developed to permit an advocate operating life for the components. Exposed surface however depositions of this slag on such surfaces may provide some protection. Therefore in MHD number of new materials must be introduced that are capable to protect themselves from corrosion and higher range of temperatures. New development and research can help to the world to reduce emission through MHD system by proper working and by removing extra energy conversation cycles.

Keywords: Power production, Gas temperature, Heating rate of Fluid, Heat loss, Friction of parts, Turbine speed and flow of Fluid in system.

Nomenclature

MHD	Magneto Hydro Generator
Gas tem	Temperature of Gas
HW	Hot water
CW	Cold water
WT time.	Waiting time
Eff GW.	Gas Turbine efficiency
Vol G	Voltage Generation
Con Temp	Temperature of Condenser .
Cool-GT	= Cooling rate of Gas Turbine

(%)

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1. Introduction.

Magneto hydrodynamics and work at lower emission and maximum higher output comma in Magneto hydrodynamic power generation heat energy is directly converted into electrical energy without conversional electric generator. The Magneto hydrodynamics power generator is a device which converts the kinetic energy of the electrically conducting material flowing in the presence of magnetic field directly into electrical energy. In conventional steam power plant hit released by the fuel is converted into mechanical energy by means of thermo cycle and mechanical energy is then used to achieve electrical generator power. There for two stages of energy conversion are involved in which the hit to mechanical energy conversion has very low efficiency full stop also rotating machine has its associated losses and maintenance problems. In MSD generation electrical energy is directly generated from hot combustion gases produced by combustion of fuel without moving parts. In MHD generator is a heat engine operating on a turbine cycle and transforming the internal energy of gas directly into electrical energy. In MHD is one such method which has considerable development. This method of the order 2300 degree Celsius to 2700 degree Celsius is compared to the conventional steam power plant which can use maximum temperature in the range of 750 degree Celsius to 800 degree Celsius. 10 MHD generators are side to have high efficiency and low pollution.

In MHD generation the pollution creation level is extremely low as compared to the different conventional system. Because high flow energy of Gas is directly converted to electrical power so number of stages that required to generate power are reduced so after all , the number process are reduced and friction among the Turbo parts are neglected. Overall efficiency of the will be increased in higher amount. So research is going on in this direction.

1.1 Working principle of MHD

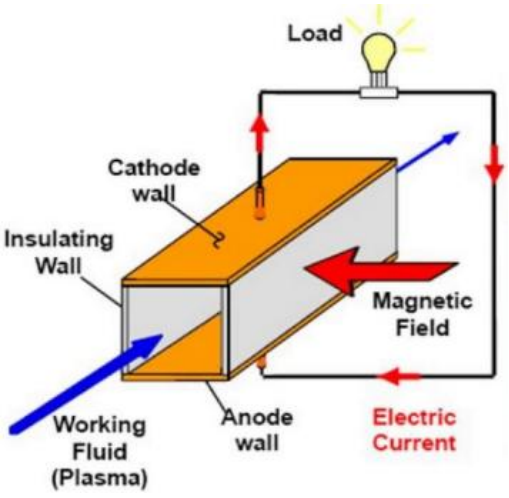

Figure 1 .Working of MHD by means high velocity gases.

Principal of MHD generation is same as the principal of conventional electrical faraday's law. Faraday's law is that when an electrical conductor moves across a magnetic field voltage is induced in it which produces and electric current. Inconventional electrical generator the conductors consists of copper strips full stop in MHD generator the solid conductors are replaced by gaseous conductors. Then ionization of gas will be done if such a gas is passed at high velocity through a powerful magnetic field then current is generated and can extracted by placing electrons in suitable positions. From an energy photo the moment of the force through a displacement is converted to electrical work by means of electromagnetic induction principle. The direct conversion of kinetic energy into electrical energy by the flow of an electrically conducting fluid usually a gas or gas liquid combination through a stationary magnetic field full stop if the flow direction is at right angles to the magnetic field direction and electro motive force is induced in the direction at right angles to the magnetic field direction.

In MHD number of factors are working that can affect the efficiency of the plant and there for the gas conductivity and other factors concern with temperature are considered for the better generation of electrical power.

2. Open cycle MHD system

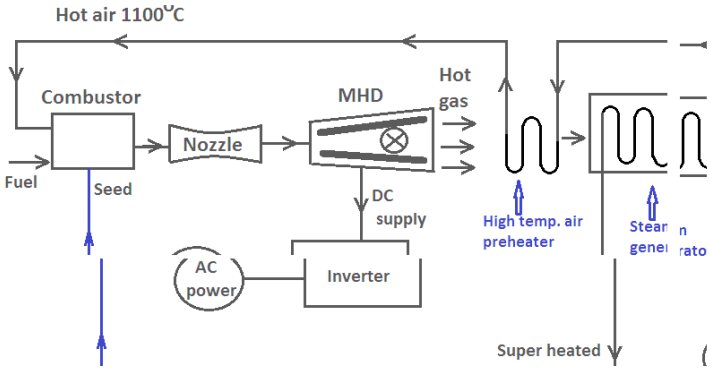

Figure 1 Working of Open cycle MHD

Arrangement of open cycle MHD power plant is mention in the figure. The system uses msd generator in conjunction with conventional steam turbine power plant. Fuel maybe coal or natural gas. The compressor is used to increase the pressure of atmospheric ton about 12 bar. The high pressure is then heated in air preheated before supplied to the combustion chamber. The temperature is about 1100 degree Celsius. If you will is burnt in the combustion chamber at high temperature up to the limit of 2600 degree Celsius and plasma level. Material like potassium carbonate is added and plasma is injected in order to increase electrical conductivity. The resulting mixture is expanded through a nozzle so is to have high velocity and then past through the strong magnetic field of about 5 to 7 Tesla of MHD generator.

As seeded gases passes through the MHD duct and negative ions move to the electrodes and so constituent and electric current. This current is dc and inverter is employed for its conversion into AC. The air leaving the MHD duct in still very hot full stop the person of heat from the exhaust gases of the MHD generator is utilised in the heating of the air supplier to the combustion chamber. Hot exhaust gases from air heater is then used to rice the steam invest heat generator. The steam so produced is used to generate additional power through a conventional turbine generator system. The seed material is recovered from the gas for successive use of harmful emissions are removed from the gas for pollution control and gas is finally discharge to the atmosphere through the chimney. Recovered seed material is recycled after mixing the additional quantity to make up for the loss of seed.

3.Close cycle MHD Cycle

3.1 Seeded inert gas MHD Generator

In a flute cycle system the carrier gas helium operates in a form of Brayton cycle. The complete system is here and three loops like combustion loop are Argon loop and steam loop. In the first loop coal is justified and burnt in a combustion chamber. The flue gases are passed through the primary heat exchanger and preheated and air purifier for removal of nitrogen and sulphur oxides and then discharge to the atmosphere. In the primary heat exchanger heat from flu gases is transferred to a career gas of the MHD cycle. Problem of extracting the seed material from fly ash does not arise due to the combustion system is separated from the working fluid. Hindi lo op at the centre is msd loop ceded inert gas is compressed and then heated in primary heat exchanger. Small quantity of seed material is then added to make up for the loss of seed through leakage. The seed is more expensive than potassium but attends Adobe conductivity at a relatively lower temperature of 1900 degree Celsius. The it is little makeup seed is required due to close operation and expensive but better seed material may be advisable.

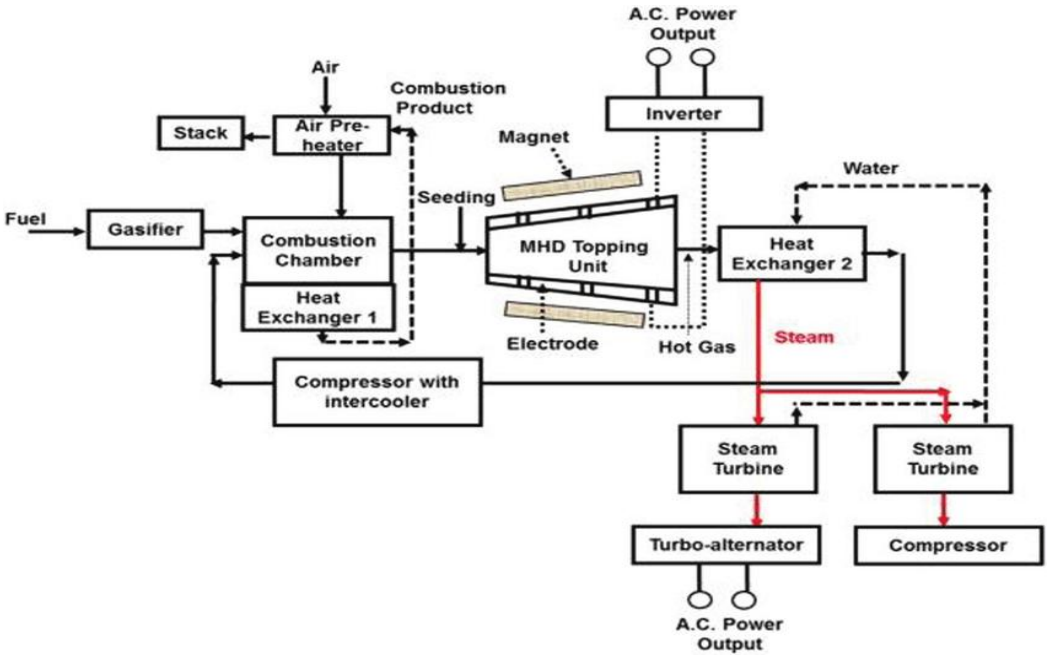

Figure 2. Seeded inert gas circulation cycle

The lower temperature operation also permits wide choice of material for various equipments full stop however operation at lower temperature also reduces thermal efficiency of the cycle. Direct current output available from the MHD generator is inverted to obtain grid quality alternate current. The loop in right hand side is the steam loop. The working fluid is slowed down in the diffusion to a low subsonic speed for further recovery of the heat of working fluid. then working fluid enters a secondary heat exchange which source is a waste heat boiler to generate steam. This team is partly utilized to drive a turbine generator and for driving a turbine which runs the helium compressor. The output of the generator is also fed to the main grid and Primary heat exchanger after passing through the compressor.

4. Liquid Metal MHD system

Hindi system liquid metal like sodium potassium lithium etc are incorporated in the inert career gas in place of seeding for conductivity requirement. this metals are excellent electrical conductors in the liquid state but there were pass are poor conductors. There for these are used in the working fluid in the liquid state only. The call is used as input energy pressurized and heated by a passage through primary heat exchanger within the combustion chamber full stop the hot gas is there incorporated into the liquid metal 2 from the working fluid. Mobiles uniformly dispersed in an approximately equal volume of liquid sodium metal. The working fluid is introduced into the MHD generator through a nozzle in the visual West the career guest then provide the required hi direct and velocity of the electrical conductor. After passage to the generator the liquid metal is separated from the career gas full stop part of the heating remaining in the gas is transferred to water in a secondary heat exchanger to produce steam for operating at turbine generator.

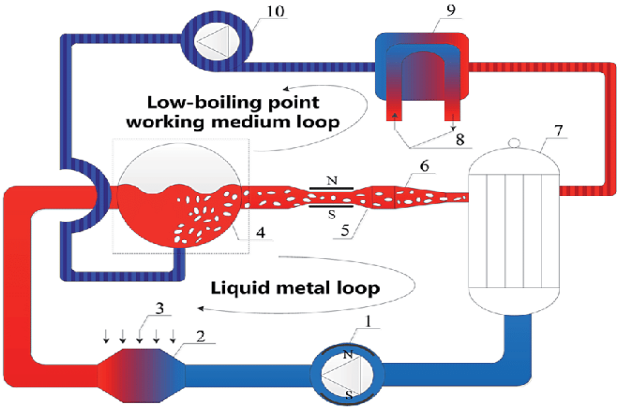

Figure 3 Working of Metal in Liquid state in MHD system

5.Merits of MHD system over other conventional system

In MHD steam hybrid plant is high efficient as around 60% the fuel is better utilized and system have no moving part there for there are more reliable the system has closed cycle therefore produces power free of pollution. MHD generators have low specific white rapid start high power density and compact size. All kinds of heat sources such as coal all gas solar and nuclear can be used with MHD generators. It has ability to reach the full power level instantly. The operational and maintenance coast or low the cost of power generation per unit is less full stop high capacity MHD generators are possible as there is no limitation to the size of the duct full stop the capital cost of the MHD plants are extinct to be competitive with those of coal fired steam power plants.

5.1. De Merits of MHD system

MHD equipments have satellite due to high temperature stresses full stop it as high fluid friction losses and heat transfer losses full stop it is very high operating temperature which restrict choice of material for various equipments full stop this are technical limitations on enhancing the fluid conductivity and the strength of magnetic field.

Conclusion

The MHD generator channel combustion chamber electrodes and air preheated are exposed to corrosive combustion gases at very high temperatures materials must be developed to permit and Adequate operating life for the components. Ash or slag residue from the burning coal is carried over with the combustion gases and tends to cause erosion of the exposed surface. However deposition of this leg on search surface is may provide some protection. Another program is separation of the seed material from the fly s and its reconversion into its original form. The materials used in construction of MHD plants must have high temperature register also the high temperature combined with alkaline atmosphere due to presence of seeding materials make the MHD extremely at higher corrosion zone. The selection of materials is very limited due to straight environmental conditions. For this selection of electrodes high temperature is required. The materials should be electrically conductive and structurally stable at high temperature refractory metals like nitrides borides are suitable materials.

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