A STUDY OF POWER SYSTEM UTILIZING WASTE HEAT ENERGY

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The waste heat energy in the exhaust gas from the industrial plant is too much. We must be needed to make the energy saving of the industrial plant because the running costs of the industrial plant are decreased.

Therefore, this study analyzed a performance about the power system utilizing waste heat gas as the high heat source and the surface sea water as the low heat source of the industrial plant.

A performance analysis of the power system is performed in the following two methods. Two methods estimated thermal efficiency of Rankine cycle and objective function for inlet and outlet temperature difference of exhaust gas. The working fluid is used TFEA (Trifluoroethanol CF_3CH_2OH) [1] which is a natural refrigerant and the heat exchanger used a plate-type heat exchangers.

Figure 1 shows a schematic of the power system utilizing waste heat energy. This power system consists of the evaporator, the turbine, the generator, the condenser, the sea water pump and the working fluid pump.

The working fluid is sent by the working fluid pump to the plate-type evaporator, where it is heated by the exhaust gas and becomes saturated vapor. The vapor then enters the turbine, and electricity is produced by the generator. The vapor that passes through the turbine enters the plate-type condenser, here it is condensed to cooling by the surface sea water.

Figure 2 shows the thermal efficiency, the heat flow rate and the work for the inlet and outlet temperature difference of waste heat gas. The inlet temperature of the waste heat gas is 150℃, outlet temperature is 95 ~ 120℃, the inlet temperature of the surface sea water is 24℃ and the velocity of waste heat gas is 20 m/s.

The thermal efficiency of Rankine cycle decreases with increases of the inlet and outlet temperature difference of waste heat gas.

The heat flow rate increases monotonously with increase of the inlet and outlet temperature difference of the waste heat gas. As a result, the work becomes convex upward and has a maximum point.

The minimum value of objective function is about 7.6 m^2/kW when the inlet and outlet temperature of exhaust gas is 45 degrees Celsius.

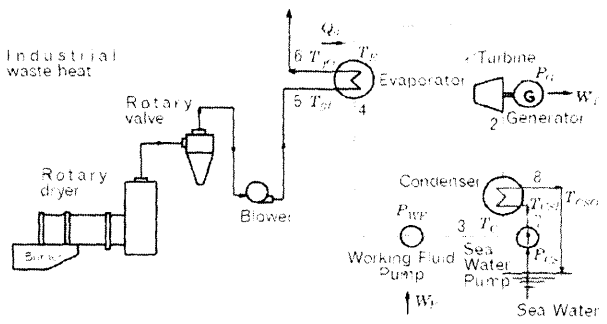

Fig. 1 Power system utilizing waste heat energy

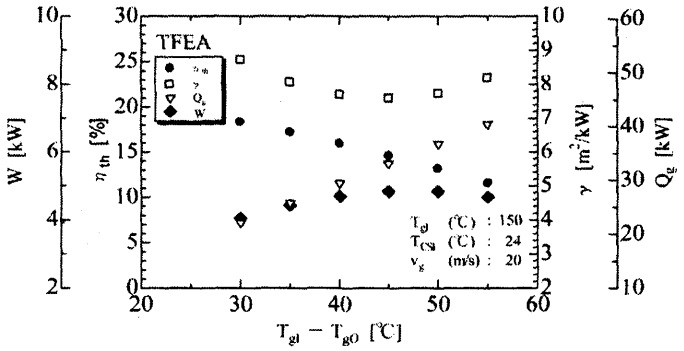

Fig. 2 Thermal efficiency, heat flow rate, work andobjective function versus the inlet and outlettemperature difference of the exhaust gas

References

[1] http://www.f-techinc.co.jp/pages/tfeain.html

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