**Title:** Design and Preliminary Tests of ORC (Organic Rankine Cycle) with Two-Stage Radial Turbine

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This paper contains a design of an ORC using R245fa as a working fluid. Specifically, a design for a two-stage turbine to improve efficiency.

“The ORC is known to have superior characteristics in terms of its simplicity and availability and is already widely applied in many practical areas.”

“In addition, the ORC is characterized by its simple structure, high reliability, and ease of maintenance. The expander of the ORC is more compact than that of the steam Rankine cycle, since the density of the ORC's working fluid is higher than that of steam. Furthermore, the compactness and efficiency of the ORC can be enhanced by utilizing a dry working fluid as it does not need a super-heater.”

Some ORC systems for large-scale industrial heat recovery, biomass and geothermal plants are commercially produced by just a few companies (TRUBODEN, ORMAT, Barber-Nichols, etc.)

“A large body of numerical and experimental research has been conducted concerning the ORC, and a number of experimental works have risen remarkably from a decade ago. However, most of the results of thermal efficiency tests conducted in previous studies were found to be low, which was mainly due to the small capacities (lower than 10kW) of the proposed systems.

This study references one run by Jung et al. which used a zeotropic mixture as a working fluid in a 1kW ORC unit.

Turbine expanders are recognized for their high efficiency and compactness, compared to vlume type expanders. Radial turbines are more suitable to systems with low flow rates and is more compact than axial turbines.

R245fa has been used in many studies because of its thermodynamic suitability for low-temperature heat recovery and environmentally friendly and safe characteristics, its molecular weight, critical pressure and critical temperature. 134 g/mol, 3640 kPa, and 427.2 K respectively.