

Chapter 4

Compact Heat Exchangers for Microturbines

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Within the distributed power generation market, the most economical solution today is to generate power through small gas turbine systems, arbitrarily categorized as microturbines (5-200 kW) and miniturbines (200-500 kW). The thermal efficiency of such microturbines without and with a recuperator is about 20 and 30% respectively, thus having a substantial performance improvement with a recuperator. The cost of the recuperator is about 25-30% of the total power plant cost, so there is an incentive to develop high performance recuperator at minimum cost. While the offset strip fin geometry is one of the highest performing surfaces, it is also expensive to manufacture due to brazing requirements. This favors the use of all prime surface heat exchangers with no brazing. Note that the compact heat exchanger surface design data are obtained experimentally in the current state-of-the art and many papers have been published. Hence, in this paper, our focus on recuperators will be on the design (various types of heat exchanger surfaces and novel designs), material/finished heat exchanger cost, performance, durability, packaging and other related issues. The discussion and coverage is primarily for metal heat exchangers since ceramic heat exchangers are still in the infant stage after the last 50 years of development associated with the gas turbine applications.

INTRODUCTION

At present, electric power is generated mainly in thermal power plants (using coal, oil or natural gas), hydro power plants or nuclear power plants. The power generation is generally in hundreds of megawatts. There is also a need for small power generation for remote areas, areas