Chapter 1

Introduction

1.1 Background

At present, there are efforts to utilize alternative fuels such as natural gas, oil shale, lignite in order to fully utilize available natural resources and to mitigate any possible impact caused by the shortage or the price increase of crude oil. One possible use of solid fossil fuels is by direct combustion to generate heat for various applications, Combustion technologies which have served well for decades are inadequate when required to burn low grade fuel with minimal emissions of SO_2, NO_x and particulates. New technologies must be developed and existing technologies improved if increasing energy needs are to be met from proper resources without environmental deterioration.

Of the new technologies now under development, one of the most promising in the medium and long term is fluidized bed combustion. It offers greater efficiency of energy utilization than gasification, liquefaction or conventional combustion with flue gas scrubbing and furthur more, is on the brink of commercial application at least in the small and medium size ranges. It readily makes possible a reduction in SO_2 emissions of up to 90 % and is inherently a low

producer of NO_x as well. Thus, it can make a significant contribution to solving the problem of acid rain.

The advantages of this new combustion process mainly involve the application of a fluidized bed as opposed to the conventional pulverized-coal combustion unit. The feasibility of reducing the sulphur emission to an acceptable level as well as maintaining efficient coal combustion is currently being demonstrated by several operations. Before operation begins, an appropriate model to describe the system is needed since it would not only make possible efficient design of future plants but also provide a basis for simulating the effects of operating parameters on the combustion.

1.2 Objectives

Hence the objectives of this study are

1.2.1 To review the progress that has been made in the modelling of fluidized-bed combustion systems.

1.2.2 To develop a system model for the atmospheric fluidized-bed combustion efficiency employing available subsystem models.

1.2.3 To test the validity of the model with experimental data of fluidized bed combustion of lignite.

1.2.4 To simulate the model for operating trends of carbon combustion efficiencies.

1.3 Scope

The scope of this work will be limited to

- atmospheric fluidized bed combustion of lignite
- modelling will be made from suitable combination and modification of existing subsystem models
- only modelling for carbon combustion efficiency will be considered
- experiments are to be run on the existing atmospheric fluidized-bed combustor with necessary modification of the test rig.