CHAPTER 6

Conclusions and Recommendation for Future Works

From the results of the experimentation and simulation, the factors that influence the formation and deposition of slag were concluded in this chapter. This thesis is considered as a conceptual basis for activities towards the understanding of the slag behavior for Mae Moh coal fired power plant. Some recommendations are identified and discussed for future works.

6.1 General Conclusions

Coal in Thailand continues to be an important source of energy for electricity generation. With remaining lignite reserve, Mae Moh power plant may face increasing slag problem, such as loss of capacity, loss of heat, boiler equipment damage, loss of time and money in maintenance boiler. This work focused on the formation and deposition of slag in Mae Moh power plant. The objective was to investigate the effect of Ca content in slag potential. The factors that influence the melting behavior of ash were investigated, using the commercial equilibrium and CFD program for prediction of the slag formation and deposition.

In this work, the lignites from Mae Moh mine were collected, blended, and analyzed for proximate analysis, ultimate analysis, heating value, and sulfur content. Thermogravimetric analyzer was also used to study the thermal degradation behavior of lignite. Ash fusibility temperature test was carried out to indicate the slag potential. For better understanding about slag formation, the slag from real operation in Mae Moh power plant were collected and analyzed for microstructural, chemical composition, and mineral composition. The parameters associated with slag potential were calculated. They were the base/acid ratio, the silica/alumina ratio, the iron/calcium ratio, and the

iron/dolomite ratio. From the results obtained, it was shown that lignite sample type E (35.11% of CaO (freeSO_3) in coal ash) was the most prone to form slag in boiler furnace, and would be hard to remove.

In an attempt to contribute towards a better understanding of the boiler slagging problems, FactSage package and ANSYS Fluent program were employed for the prediction of slag formation and deposition. FactSage, equilib and phase diagram models, were used to predict the formation of slag, and compared with the ash fusibility temperature test. The results were found to be in good agreement. The ANSYS Fluent CFD model was used to predict the deposition of slag. The simulation was able to provide heat flux trend for the case study. It was shown that the burner zone had higher slag potential. Although, the results from CFD simulation cannot be used to predict the deposition rate of slag directly, it may be applied to predict the possibility of slag deposition and correlating the heat flux zone with different coal properties and power plant operations.

6.2 Recommendation for Future Works

Based on the results, the following recommendations were made for better analysis and simulation results of slag formation and deposition.

6.2.1 There are many factors affecting the slagging potential in boiler furnace. In this thesis, only composition of coal and ash, melting point of ash, base/acid ratio, iron/calcium ratio, silica/alumina ratio, and iron/dolomite ratio were considered. Viscosity is one of the factors that many research were investigated on the slag problem in several coals. So far, it has not been tested with the Mae Moh coal. The viscosity can be measured using the rotating cylinder method for viscosity of the slag. Prediction of viscosity can be obtained from FactSage program. Therefore, it is suggested to investigate the viscosity further for a better understanding of the structure of slags from Mae Moh lignite.

6.2.2 From the usage of FactSage program in this work, the results of slag formation prediction gave good accuracy, compared with the experiment. In addition, the program can be used to calculate and presente the slag composition and mineral component, along with the results from XRF, and XRD. In this work, the fused ash obtained from AFT test was very small. This might not be sufficient for further XRF and XRD analyses. So, alternative methods for generating ash fusion and collecting fused ash samples may be employed, such as drop tube furnace testing, to clearly analyze the cause of slag formation.

6.2.3 For CFD simulation of the real case, the real data of coal properties and Mae Moh power plant operation in the past were required. So, many data are needed from the references as closely as possible, which and affect accuracy, with respect to the measured results. To increase the correctness of CFD simulation, the parameters used should be derived from the experiment such as coal properties (activation energy, density) and boiler operation (burner tilting, the velocity and coal feed of each windbox). In the future, appropriate measuring devices should be equipped in the experiment. The better results may be compared with the simulation results.