

Ma, YL, M.E.Sc., "Heat Transfer Studies in a Gas-Solids Downflow Fluidized Bed (Downer)", The University of Western Ontario, April 1998.

### **Abstract**

Heat transfer between gas and solids flow suspension and the surface immersed in the bed was studied in a 9.3 m high, 100 mm inner diameter gas-solid co-current downflow fluidized bed (downer) with 65  $\mu$ m FCC particles. The radial and axial distributions of heat transfer coefficients between the suspended surface and the gas-solids flow suspension were obtained using a miniature cylindrical heat transfer probe under different operating conditions. The gas-solids mixing efficiency in the entrance region of the downer was studied based on a thermal method, with which the gas-solids contact efficiency was estimated through measuring the temperature change of hot fluidized air in the bed by a shrouded thermocouple. The solids concentration and particle velocity, which are considered as two of the most influential factors to the gas and solids flow, were measured by two separate optical fiber probes. The results show that heat transfer and gas-solids mixing behaviors are all controlled by the hydrodynamics in the bed, and there is a close relationship between the heat transfer coefficient or gas-solids contact efficiency and the solids suspension density. Utilizing this characteristics and through studying the heat transfer behavior with different types of distributors, the effects of distributor structure on the flow pattern and development in the entrance region of the downer were also investigated and characterized. The operating conditions and entrance structure (distributor) have been found to have significant effects on the gas and solids flow structure, gas-solids mixing and heat transfer behaviors in the downer.