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MEASUREMENTS OF BUBBLE CHARECTERISTICS IN FLUIDIZED BEDS

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Several attempts are reported on measurements related to bubbles and their movements in fluidized beds under normal conditions as well as under high temperature operations such as combustion. The methods used are surface photographic methods, application of probing light sensors, capacitance sensors in the bed, x-ray, γ-ray, laser and cine photographic methods, all involving various data processing techniques. This paper describes a method for measurements of bubble sizes, velocities and frequencies in a bio mass gasifier operating at about 1000 K with a sand bed as the inert heat carrier.

The transient pressure variation in the gasifier is monitored using two minute pressure transmitters connected to the probes horizontally placed with known tip coordinates within the bed. The output voltages from the transmitters are connected to the analog/digital (A/D) converter a computer. The voltage variation with time is monitored using data acquisition software. The time shift between the two signals is derived from the peak of the cross correlation plot. Using this parameter the bubble velocity is calculated. The time shift between maxima and the subsequent minima is measured from the plot of the voltage vs time graph, which is used to calculate the bubble diameter. The average bubble frequency is the peak of the power spectral density vs. frequency plot. The measurements were carried out for a pilot scale fluidized bed gasifier under working conditions and an identical sized cold model. The variation of bubble properties with various fluidizing air velocities, sand height, the amount of bio mass in the bed were studied and the bubble parameters of gasifier were compared with the model and with the theories of other workers.

The measured bubble properties show negative deviation (low values) from the corresponding simulated values using empirical equations available. The bubble diameters are lower for the gasifier than the theoretical values with a small negative variation with model and the theories. Temperature variations during the bubble measurements also monitored which showed the isothermal behavior of the gasifier.