BURNERS, COMBUSTION AND HEAT TRANSFER

(613) - CONTACT HEAT TRANSFER ANALYSIS IN FLIGHTED ROTARY KILNS

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Rotary drums are used for the thermal treatment of granular material. Designs such as flights are installed to improve the mixing of the material and, in particular, to increase the heat and mass transfer between the gas phase and the solid particles. The flights lift the particles out of the bulk bed and throw them as curtains into the passing gas phase of the drum. This also affects the contact area and contact heat transfer between the rotating drum and the particles. In this study, the contact heat transfer is experimentally investigated in a rotary kiln with a length of 1.76 m and an inner diameter of 0.5 m. The drum is indirectly heated by an electric heating system. The temperature inside the drum is measured with type k thermocouples at different axial, radial and circumferential positions to obtain 3-dimensional temperature distributions. To determine the heat transfer coefficient, the drum is heated to 350 °C in batch mode with both ends of the rotary drum insulated to avoid axial gas flow. During heating, the temperature profiles of the gas, the granules and the flight and drum walls are measured. Energy balances are derived using the resulting temperature gradients and differences. Based on the energy balances of the granules, the contact heat transfer and the contact heat transfer coefficient are determined. Glass beads with a particle diameter of 4 mm are used as reference test material. Operational (rotational speed, filling degree), flight design (number of flights, flight length ratio) and material parameters (particle diameter, material) are varied. Models for calculating the contact heat transfer coefficient in flighted rotary drums cannot be found in the literature, so the measured values are compared with model values from the literature for unflighted rotary kilns. This shows good agreement for most of the parameters investigated.

Palavras-chave : Rotary drum, Heat transfer coefficient, Model matching, Baffles, Granular matter