96/00675 The decomposition flame of hydrazine in inert porous media

Koshkin, B. Y. *et al., Combustion & Flame,* Nov. 1995, 103, (3), 143-150.

The propagation of thermal waves of N_2H_4 decomposition in capillary-porous media of two types has been studied with filtrational supply of the reactant to the decomposition zone. Steady-state decomposition regions have been examined. Parameters affecting the burning velocity and thermal wave propagation velocity have been determined. Thermal wave structure has been found to involve an anomalously wide preheat zone, due to the effect of capillarity. In this zone hydrazine appears in both liquid and gaseous states, the liquid and gaseous mass flows being, in fact, non-one-dimensional. The decomposition process causes internal capillary filtration. A physical model of decomposition flame hydrazone in porous media is discussed.

96/00676 Development and testing of diesel engine CFD models

Reitz, R. D. and Rutland, C. J. *Prog. Energy Combust. Sci.,* 1995, 21, (2), 173-196.

The developments and validation of Computational Fluid Dynamic (CFD) models for diesel engine combustion and emission is described. The complexity of diesel combustion requires simulations with many complex, interacting submodels in order to be successful. This review focuses on the current status of work at the University of Wisconsin Engine Research Center. The research program, which has been ongoing for over fives years, has now reached the point where significant predictive capability is in place. A modified version of the KIVA code is used for the computations, with improved submodels for liquid breaking up, drop distortion and drag, spray-wall impingement with rebounding, sliding and breaking-up drops, wall heat transfer with unsteadiness and compressibility, multistep, sliding and breaking-laminar-turbulent characteristic time combustion models.

96/00677 Development of an automatic system for cleaning the carbon in ascension pipes of coke ovens

Park, S. D. and Chung, W. K. *RIST Yongu Nonmun,* 1995, 9, (1), 56-64. (In Korean)

96/00678 Development of pulverized coal fired low NO_x advanced PM burner

Kaneko, S. *et al., Mitsubishi Juko Giho,* 1995, 32, (1), 23-26. (In Japanese)

The paper describes how Mitsubishi Heavy Industries Ltd achieved low NO_x combustion by applying the circular corner firing combined with the pollution minimum burner, the in-furnace NO_x removal system MACT (Mitsubishi Advanced Combustion Technology) and high fineness MRS pulverizer. The objective was to develop an advanced burner which achieves low NO_x high burn out and at the same time allows a simple design of the burner.

96/00679 Devolatilization of coal particles in a flat flame – Experimental and modeling study

Therssen, E. *et al., Combustion & Flame,* Oct. 1995, 103, (1), 115-128.

Pulverized coals have been tested under the conditions of industrial flames, with high heating rate and high temperatures. Coal particles were injected (5 g/h) into a flat, air-propane flame at 1400°C. The chars were collected after different pyrolysis times. The thermal history of the particles, as monitored by two colour pyrometry, shows that particles undergo very large heating rates (6×10^5 K/s) and reach a peak temperature of 1100°C. For eight coals (volatile matter 1-57% d.a.f.), the devolatilized fraction of coal has been measured, as well as those of carbon, hydrogen and nitrogen. In every case, the devolatilized fraction of coal was greater than the predicted A.S.T.M. value, but proportioned to it. The devolatilized fraction of hydrogen seems to be a more sensitive parameter than the coal's weight loss.

96/00680 A direct comparison of pair-exchange and IEM models in premixed combustion

Correa, S. M. *Combustion & Flame,* Nov. 1995, 103, (3), 194-206.

Two pair-exchange mixing models, viz., the original Curl model and a modification thereof, are compared with the 'Interaction-by-Exchange-with-Mean' (IEM) model, in the context of homogeneous combustion. The IEM model is attractive because it permits highly 'parallelizable' computation, but the consequences of certain peculiarities – such as determinism and the shape-preserving relaxation of the initial pdf of a conserved scaler – need to be examined in the context of combustion. A numerical simulation of a partially stirred reactor is used to directly compare the three models, without the additional errors that contaminate comparisons made in simulations of flowfields.

96/00681 Direct observation of single coal-particle combustion in a laminar-flow furnace

Ariyama, T. *et al., Tetsu to Hagane,* 1995, 81, (7), 703-708. (In Japanese)

Describes the experiment on a single coal particle combustion which was carried out with a laminar flow furnace to clarify the fundamental combustion mechanism of pulverized coal particles injected into the blast furnace. A high speed camera was used to observe the coal particle combustion, and the temperature distribution nearby the coal particle was estimated by the image analyzer. A flame sheet around the particle due to the combustion of volatile matter was observed after the ignition, and it was found that the radius of flame was dependent on the oxygen concentration and coal type.

96/00682 An economical solution for reducing NO_x emissions from cell burner boilers firing pulverized coal

Penterson, C. A. and Dorai, X. A. *Proc. Am. Power Conf.,* 1995, 57, (2), 1188-1193.

The paper presents the results of retrofitting American Electric Power's Muskingum River Unit 5, a 600 MWe supercritical cell burner boiler with Riley low NO_x CCV burners. Results of this project successfully demonstrated the ability to reduce NO_x emission >59% without the requirement for overfire air, off stoichiometric firing, burner respacing, mill system or coal piping changes or pressure part modifications.

96/00683 Effect of pressure on oxidation rate of millimetre-sized char particles

Bateman, K. J. *et al., Fuel,* Oct. 1995, 74, (10), 1466-1474.

Mass losses and burnout times of large (0.1,0.2g) char particles at pressures of 101-760 kPa were measured in a newly designed high-pressure reactor. A cantilever balance measured instantaneous particle mass and an optical pyrometer measured particle temperature continuously. The process was also videotaped. Sixty-two combustion experiments were conducted with a bituminous coal and a lignite. The reactor air temperature was approximately 900 or 1200 K and the air flow Reynolds number was varied by a factor of two. Coal particles were placed in a platinum-wire basket inside the reactor at the end of the balance beam. An ash layer accumulated around the particles and receded as the char was consumed. In all tests a linear decrease in cube root of char mass with time was observed during oxidation until near the end of burnout.

96/00684 Effects of pressure, gas temperature and CO_2 and O_2 partial pressures on the conversion of coal-nitrogen to NO, N_2O and NO_2

Aho, M. J. and Pirkonen, P. M. *Fuel,* Nov. 1995, 74, (11), 1677-1681.

The effects of pressure (2-16 bar), gas temperature (800-1100°C) and the partial pressure of carbon dioxide (0.01-4 bar) and oxygen (0.2-2bar) on the formation of N_2O,NO and NO_2 from coal-N were studied.

96/00685 Experimental investigation of the two-phase theory in a fluidized-bed combustor

Stubington, J. F. and Cui, Y. *Int. J. Energy Res.,* Nov. 1995, 19, (8), 699-719.

Though the two-phase theory of fluidization is well-accepted, no direct experimental measurements of the different gas concentrations predicted to occur in bubble and particulate phases could be found in the literature. For the first time, theoretical predictions of these different gas concentrations have been validated experimentally, using a combined oxygen/bubble probe. Based on the two-phase theory, a mathematical model was developed for the combustion of a batch of char particles in a fluidized-bed combustor. The experimental oxygen concentration in the particulate phase as a function of time was well predicted by the model. Slight discrepancies for the bubble phase values were eliminated when low-oxygen-concentration bubbles were excluded from the data, attributed to some char combustion occurring in bubbles being contrary to the model assumption.

96/00686 Experimental study and modeling of dodecane ignition in a diesel engine

Sahetchian, K. *et al., Combustion & Flame,* Nov. 1995, 103, (3), 207-220.

Describes how two experiments were performed under conditions as close as possible to those existing in a diesel engine.

96/00687 Experimental study of a high-efficiency, low emission porous matrix combustor-heater

Xiong, T. Y. *et al., Fuel,* Nov. 1995, 74, (11), 1641-1647.

The porous matrix combustor-heater is a combined combustion-heat-transfer device in which the heat exchange surfaces are embedded in a stationary bed of refractory material where gaseous fuel is burned. A basic experimental study was conducted on a 60 kW bench-scale porous matrix combustor-heater with two rows of water-cooled tube coils to evaluate its performance and explore the mechanism of combined convective-radiative heat transfer and its interaction with combustion in the porous matrix. Combustion stability in the porous matrix, heat-transfer rates, emissions and pressure drop through the unit were investigated under different conditions.