k_2 = reverse reaction rate constant for the aqueous dissociation of acetic acid
l = constant ($= \gamma/\beta$), cm
M = molecular weight, g/gmole
m = number of antacid tablets present
N = moles of a substance, gmoles
n = order of process with respect to hydronium ion concentration
pH = $-\log(C_A)$
R = initial radius of an antacid tablet, cm
r = instantaneous radius of an antacid tablet, cm
t = time, min
V = volume of reaction solution, liters
x = mass fraction
α = aspect ratio of an antacid tablet ($= H/R$)
β = constant defined by Eq. (11)
γ = constant defined by Eq. (10), cm
ρ = density of a tablet, g/cm^3
[ ] = concentration of, gmole/liter

Subscripts

A = acid (H_3O^+)
B = base ($CO_3^=$)

Superscript

O = initial condition (t = o) □

ChE book reviews

COAL LIQUID MIXTURES: Proceedings of the Third European Conference

edited by T. J. Pierce, et al
Hemisphere Publishing Corp., 79 Madison Ave., New York, NY; 409 pages, $82.50 (1988)

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Published by the European Federation of Chemical Engineers (EFCE Publication Series No. 64, EFCE Event No. 372), this book is a report on a two day symposium held in Malmo, Sweden, 14-15 Oct 1987 (ISB No. 85295 2139). CLM-2 the 2nd European conference on this topic held in London (1985) reflected optimism on the future of CLM as well as a consolidation of works on the stability, atomization, and combustion characteristic of slurry technology. On the other hand, CLM-3 recognizes that the 1986 fall of world oil prices has generally delayed the commercial realization of CLM. The papers presented provide mostly an update of technological developments on coal water mixtures (CWM). They cover slurry preparation at pilot and commercial scales, slurry atomization including an analysis of droplet mechanisms and influence of dispersants, and slurry combustion including an assessment of mineral matter transformation and reaction kinetics. Most of the CWM combustion programs in Europe are carried out on converted utility and industrial boiler plants. Whereas most USA CLM programs have emphasized the use of premium grades of coal, the European program gives considerable emphasis to the use of low-grade fuels of high ash content where local economic factors are favorable including coal washery fines. Commercial application of slurry to steam generation, to aggregate cement kiln firing and to open hearth furnaces are discussed in considerable detail reflecting the technological maturity of the use of CWM.

Economic and marketing aspects of coal liquid mixtures are nicely summarized in Chapter 27 by N. Lood on "Coal Water Fuel (CWF) in a Changing Market." He points to the increases of oil prices in 1973 and in 1979 which focused attention on the need to develop alternatives to oil and to the recent emergence of CWF as the leading candidate. He discusses CWM fuels advantages in terms of high coal reserves, market stability, the preservation of the fluid infrastructure, the safety and environmental cleanliness, and the fact that existing oil boilers could be utilized with minimal changes and low retrofit costs.

The oil price collapse of 1986 from the $30 per barrel range to the $10 per barrel range had a major impact on CWF. The reaction in the USA where market forces are predominant was almost immediate, and most development projects were shelved or drastically scaled down. This conference proceedings suggests that Europeans have taken a longer range perspective and are giving somewhat greater attention to the security of energy supply upon the stability of European economies *vis-a-vis* actions of the OPEC cartel. Of the member states in the European Economic Community, Italy is making the greatest progress in the use of CWF. From the continued advancement of CWM technology in Europe it would appear that the technological lead which the US had in 1985 might have been transferred abroad. The recent Clean Coal Technology program might, however, restore the US position.

This reviewer finds it difficult to understand why co-combustion of coal water fuel with natural gas has received practically no attention in Europe. Natural gas is available from the USSR, Northern Africa, and the North Sea, and its price tends to track the price of oil. Co-combustion of coal water fuel with natural gas (CWG fuel) provides advantages in the form of emission reduction, energy enhancement, flame stabilization, and other technological benefits (see *An Alternative to Oil: Burning Coal with Gas,* University Presses of Florida, 1981, and *Co-Combustion ASME FACT,* Vol 4, 1988, HOO443). In this reviewer's opinion, when oil prices climb above $20 per barrel again, CWG fuel will be the most competitive alternative to oil from environmental, energy, and economic standpoints. ❑