Koch, Donald L.; **Brady, John F.**
Dispersion in fixed beds. (English) Zbl 0592.76130
J. Fluid Mech. 154, 399-427 (1985).

The authors discuss the heat and mass transfer through a bed of particles with fixed positions when the average velocity through the bed is constant. The problem is handled through an asymptotic analysis. For all values of the Péclet number, the leading effect of the particles at low particle volume fraction is determined on the dispersive behaviour of the bed. Dispersion at low Péclet numbers and mechanical dispersion at high screening-length Péclet numbers are discussed. Results of the theoretical analysis are compared with experimental work reported earlier. The agreement is shown to be remarkably good. Justification of the asymptotic analysis is also given in the appendix.

Reviewer: Y.N.Gaur

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80A20 Heat and mass transfer, heat flow (MSC2010)

Keywords:

mass transfer; bed of particles with fixed positions; asymptotic analysis; low particle volume fraction; Dispersion at low Péclet numbers; mechanical dispersion at high screening-length Péclet numbers

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References:

[1] Saffman, Stud. Appl. Maths 52 pp 115– (1973) · Zbl 0264.76077 · doi:10.1002/sapm1973522115
[2] DOI: 10.1017/S0022112059000672· doi:10.1017/S0022112059000672
[3] Reis, Sep. Sci. Tech. 14 pp 367– (1979)
[4] Carton, Physica 119A pp 307– (1983) · Zbl 0523.60076 · doi:10.1016/0378-4371(83)90162-0
[5] DOI: 10.1016/0009-2509(83)85036-2· doi:10.1016/0009-2509(83)85036-2
[6] Brenner, Phil. Trans. R. Soc. Lond. 297 pp 81– (1980)
[7] Batchelor, Proc. R. Soc. Lond. 355 pp 313– (1977)
[8] DOI: 10.1146/annurev.fl.06.010174.001303· doi:10.1146/annurev.fl.06.010174.001303
[9] Adler, Physico Chem. Hydrodyn. 5 pp 269– (1984)
[10] DOI: 10.1063/1.1706630 · Zbl 0109.18605 · doi:10.1063/1.1706630
[11] DOI: 10.1017/S0022112080001723 · Zbl 0466.76081 · doi:10.1017/S0022112080001723
[12] DOI: 10.1007/BF01225144 · Zbl 0399.60049 · doi:10.1007/BF01225144
[13] Jeffrey, Proc. R. Soc. Lond. 335 pp 335– (1973)· doi:10.1098/rspa.1973.0130
[14] DOI: 10.1017/S0022112077001414 · Zbl 0374.76038 · doi:10.1017/S0022112077001414
[15] Gunn, Trans. Inst. Chem. Engrs 47 pp T341– (1969)
[16] DOI: 10.1016/0009-2509(81)85058-0· doi:10.1016/0009-2509(81)85058-0
[17] Fried, Adv. Hydrosci. 7 pp 169– (1971)· doi:10.1016/B978-0-12-021807-3.50008-4
[18] DOI: 10.1016/0009-2509(83)85037-4· doi:10.1016/0009-2509(83)85037-4
[19] DOI: 10.1017/S0022112076002814 · Zbl 0346.76022 · doi:10.1017/S0022112076002814
[20] DOI: 10.1016/0017-9310(67)90045-2· doi:10.1016/0017-9310(67)90045-2
[21] Sangani, Proc. R. Soc. Lond. 386 pp 263– (1983)
[22] Sahimi, J. Chem. Phys. 52 pp 115– (1983)