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Research on Particles at the Department of Chemical Engineering at the University of Sydney

D.F. Bagster, Australia

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Investigación sobre partículas en el Departamento de Ingeniería Química de la Universidad de Sydney

シドニー大学工学部における粒子についての研究

悉尼大学化工系所进行的粒子研究

ابحاث الجسيمات بشعبة الهندسة الكيماوية بجامعة سدني

1. Flow of Solids

On-going research into the flow and frictional properties of granular materials, beginning with the successful application of soil mechanics to the behaviour of powders under the action of blades [1, 2, 3, 4, 5, 6].

Tests on a large number of different shear cells with the result of having discovered some fundamental differences among the results of various types. One of the cells, the Jenike flow factor tester, has been used to solve industrial flow problems. The Electricity Commission of New South Wales has donated the largest annular shear cell in the world while the Hosokawa Micromeritics Laboratory, Japan kindly provided a Powder Characteristics Tester for evaluation [7, 8, 9].

Work has been initiated on the segregation of particles in bins including a successful theory to correlate such behaviour [10, 11]. This study is continuing.

Studies on the blending of powders including a successful theory to explain the semi-logarithmic mixing correlations [12, 13, 14, 15].

Tests on the storage and caking of raw sugar, including the recent discovery of enormous temporary increases in caking strength of great concern to the industry. The first identification of a crystalline bridge in raw sugar, always hypothesised to be the cause of the strength of caked sugar. Work is now continuing on various types of raw sugar [16, 17, 18].

An on-going study of the flow properties of powder mixtures. Little work has been done on this most important aspect of powder behaviour: important in pharmaceuticals, coal handling and mineral dressing [19, 20, 21].

An initial study of devices to measure the stresses on silo walls from the material contained therein.

2. Aggregation of Particles

Theoretical studies of the break-up of idealised models of flocs in fluid flow leading to a predicted correlation of floc size as a function of impeller speed in a tank [22, 23, 24].

Experimental studies of the flocculation of minerals in a stirred tank system not only verifying the above predictions but leading to important conclusions on the nature of the formation and break-up of flocs [25].

Based on this work an extension is currently being undertaken. Work is proceeding on the physical aspects of the flocculation process with particular reference to the selective flocculation of minerals from each other. This work is potentially important since it is a promising method where more conventional mineral dressing techniques are inadequate.

3. Flow Through Particle Beds

Fluid flow through porous media including a new theory for hydrodynamic instability when one fluid displaces another. This theory agreed with experiments and will have important applications on oil reservoir recovery problems. This work is continuing [26, 27, 28].

Chemical engineering principles were applied to the mass transfer of cane sugar colourants to ion-exchange resins enabling decolourisation processes to be modelled [29, 30, 31, 32].

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Dr. D.F. Bagster, Senior Lecturer, Department of Chemical Engineering, The University of Sydney, Sydney, N.S.W. 2006, Australia

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