PUBLICACIONES.

'On the Modeling of Fluidized Reactors for Hot Gas Clean-up'.

Perales, J.F.; Navarro, J.; Puigjaner, L.. Pp. 993-1001, International Symposium of the Engineering Foundation, Large J.F., Laguérie C. Eds., Pre-prints , New York (1995).

ABSTRACT.

The elimination of hydrogen sulphide from coal gas using metal oxide sorbents in Fluidized Bed reactors (FB) is emerging as a promising and reliable technique after modelling. Alternate reactor types such as circulating FB, turbulent FB, moving or fixed beds are also candidates for supporting this process. The choice between them primarily depends on the availability of the proper solids.
Extensive effort is currently being devoted to reducing the contaminants released into the atmosphere during energy production from solid fuels. IGCC (Integrated Gasification in Combined Cycle) is viewed as a viable technique for increasing the thermal efficiency of the whole process, producing less CO_2 per kW obtained.
In IGCC plants it is necessary to reduce the H_2S content in the gas stream before entering the gas turbine to less than 20 vppm from the several thousand vppm it contains at the output of the gasifier. This can be achieved with a low-temperature wet process, but new processes under development, which work at high temperature and pressure, increase the thermal efficiency of the whole plant.
These new techniques use solid sorbents of metallic oxides that react with H_2S according to this general expression:
MeO_x (s) + x H_2S (g) ---------> MeS_x (s) + x H_2O (g)
and can be regenerated to the original form by combustion with O_2 or with SO_2:
MeSx (s) + 3/2 x O_2 (g) ----------> MeO_x (s) + x SO_2 (g)
or
MeS_x (s) + x/2 SO_2 (g) ----------> MeO_x (s) + 3/2 x S (g)
Thermodynamic equilibrium shows that the H_2S content at the gas outlet can be reduced to the few ppm required.
These solids are being developed to improve their life cycle and to make the process cheaper, which means: increasing crushing strength, increasing the percentage in weight of active component in the support, and chemical and physical stability of the solid throughout the highest possible number of absorption-regeneration cycles.

'Development and Testing of a HT-HP Regenerative and Continuous Desulphurisation Process for IGCC Concepts'.

Perales, J.F.; Navarro, J.; Puigjaner,L.. J.H.Kiel and P.J. de Wild Eds. ECN, The Netherlands (1996).
With contributions from: Meijer R., Weijers H.M., Janssen F.J.J.G. (KEMA, Nd); Eckersley N., Sambrook (Dycat, G.B.), Farina G.L. (Foster Wheeler, It), van Yperen R., Lamers M.D.A. Geus J.W. (University of Utrecht, Nd), Perales J.F., Navarro J., Puigjaner L. (UPC, Sp), de Wild P.J., Schenk E., Kiel J.H.A. (ECN, Nd)

ABSTRACT.

Application of high temperature gas cleaning (HTGC) instead of conventional wet scrubbing has the potential of increasing the overall thermal efficiency and decreasing the capital requirements and electrical power generating cost of Integrated Gasification Combined Cycle (IGCC) systems. This paper describes the results of a project focused on a key process step in each integrated HTGC concept, viz. high temperature removal of

sulphur compounds or desulphurisation. The project was aimed at generating commercial viable sorbents validated on lab- and bench-scale, improved reactor concepts and design tools for scale-up purposes.
The project started from promising sorbent concept, viz. supported iron oxide/molybdenum oxide. However, it consisted of a powder prepared by homogeneous deposition precipitation, which is an unattractive technique for large scale sorbent preparation. In the current project, the sorbent development was taken from there through many iterative steps, comprising sorbent preparation, characterisation and lab-scale validation, yielding finally three commercially viable sorbent preparation methods. Most promising sorbent have subsequently been validated on bench-scale. Finally, based on the sorbent performance demonstrated, commercially attractive process schemes have been developed. This means that a large step forward has been made towards pilot-plant demonstration of a high temperature desulphurisation process based on one of these concepts.

'Curso de Ingeniería Ambiental: Tecnologías de gasificación'.

Perales , J.F,
X. Flotats Ripoll Ed., pp. 182-222. Lleida. (1997).

RESUMEN.

Dentro del curso de ingeniería ambiental, se hace en este capítulo una descripción de las características de los diferentes gasificadores, realizando una análisis comparativo de las distintas tecnologías en cuanto al flujo de gas y sólido, tamaño de partículas, calidad de la materia prima, uso de sistemas presurizados, composición del gas producido, etc. Planteándose la situación actual y las perspectivas de futuro para la tecnología de gasificación.

'Elimination of H2S from the gas of gasifiers at high temperature and pressure using sorbents in bubbling and circulating fluidized beds: Comparison of experimental and simulated results'.

Perales, J.F.; López, L.M.; Pan, Y.G.; Manyà, J.; Danner, J.; Velo, E.; Puigjaner, L. II European Conference on Fluidization. pp. 469-476. Olazar-San José eds., Bilbao (1997).

ABSTRACT.

This article shows experimental results obtained in two lab-scale plants working in bubbling (BFB) and circulating fluidized (CFB) regimes, respectively, used for the elimination of hydrogen sulphur from gasification gases. The optimization of the design and operation conditions of the plants are appreciated in the good operation of the absorption cycles in the metallic oxides that compose the particles bed. The results are used to validate the outlined mathematical model. It is put of manifesto the influence of the composition of the gas (reducing power) in the kinetic of reaction, and with this in the useful absorption capacity of the solid.

'Particle Balance in Fluidized Systems, Considering Continuous and Discontinuous Variations of the Variables that Define the Population, and Residence Time Distribution'.

Perales, J.F.; Puigjaner, L. II European Conference on Fluidization. Bilbao pp. 165-172. Olazar-San José eds.. (1997)

ABSTRACT.

It is presented a general mathematical treatment of the balance of particles for a BFB for steady and dynamic state, in which the variables that define the population can be multiple, not only the typical ones as size or diameter and density. The resolution method is developed, and results are presented in form of examples in which the residence times distribution is obtained. The equations also for the general method that considers continuous and discontinuous variations of the variables are developed.

Keywords: Fluidization, Particle Balances, RTD, Fluidized Beds.

'Simulation Strategies for BFB'.

Perales, J.F.; Puigjaner, L.; Récents Progrès en Gènie des Procedés., p. 583-589. Vol. 14, Nº 75, Société Française de Génie des Procédés eds., Nancy (2000).

ABSTRACT.

Two methods are presented for the simulation of Bubbling Fluidized Beds The first uses empirical rules that are implemented in a mathematical model, in which bubble appearance, coalescing, disappearance, formation of slugs, distribution of sizes of bubbles, can be calculated easily, using very few calculation time. The second is based on the resolution of the balances of mass and momentum, rigorously, but it presents the inconvenience of needing excessive computing time. The practical application is focused in finding the values of vital parameters for the calculation of BFB.