

NEW STATE OF ART IN SOLID PHASE REACTION

Solid phase reactions are classified as reactions in which the major constituent of the reacting mass is a solid, whether as a reactant, reaction product, or catalyst. Solid phase reactions of necessity have been conducted since the existence of the chemical process industry but only recently has a commitment to solid phase reaction from suspension or dilute slurry reaction developed on the basis of economic and environmental conditions.

The underlying factors influencing the development of solid phase reaction technology are related to the significant energy savings, the reduction or elimination of by-product diluent streams to comply with the environmental guidelines, and the increased reaction yields and resultant reactant savings. Essential to the development of solid phase reactions are suitable process hardware in which to implement these reactions and the development of peripheral process technology.

Littleford Day, Inc. has been a pioneer in the development and implementation of solid phase reaction technology. Documented cases exist where the total energy requirement of a process has been reduced by more than 50%. In many instances, difficult and costly solid-liquid separation operations are eliminated. Yields have been increased in many processes from 50% to 99.5%, resulting in dramatic improvement of process economies. Perhaps the most profound element of solid phase reaction technology is the ability to conduct reactions that previously could not be accommodated by alternative methods.

The Littleford Polyphase® vessel is designed to accommodate the special process requirements of solid phase reactions. The unit has the inherent ability to mechanically fluidize granules, powders and slurries, continuously remove by-product gases or liquids, and remove heat during the reaction. Most importantly, it accommodates the different stages existent throughout the course of a chemical reaction.

One of the techniques utilized to optimize the course of a solid phase reaction is to retard the quantity of liquid reactant or diluent to maintain the reaction mass in a near dry state without sacrificing mass transfer. Solid granules and powders exhibit a characteristic, apparent viscosity behavior as the relative quantity

of diluent is increased. From a free flowing dry state at zero diluent, the material reaches a peak apparent viscosity where the bonding effects of the diluent-solid are maximized at intermediate concentrations of diluent, followed by a reduction in apparent viscosity as the excess diluent minimizes the bonding effects. With empirical data, the reaction can be conducted away from the range of high viscosity and tackiness, reducing the total power input and avoiding fouled heat transfer surfaces. The addition of liquid reactants can be synchronized to the on-going reaction which consumes them. It is mandatory, however, that transport functionality not be sacrificed; techniques have been developed to accomplish this objective.

Another technique is referred to as "concentration driving" or establishment of a reactant concentration throughout the course of a reaction to retard the formation of undesired by-products, increase the yield of the reaction, and to implement other stoichiometric objectives.

Other parameters that may be altered throughout the course of the reaction are temperature and pressure. As a reaction proceeds to 100% or desired conversion, it may be advantageous to increase the overall reaction rate constant by increasing the temperature or other process variable. Over-pressure allows process vapors to be maintained in the liquid state, increasing transport properties.

The Littleford Polyphase® vessel is completely jacketed with flow channels to yield efficient heat transfer. Vessel connections are provided in accordance with the requirements of specific applications. Liquids or gases may be added or removed during a particular process. The Polyphase® vessel is designed for operation at vacuum and pressure conditions over a wide range of temperatures.

The Littleford Polyphase® System achieves simultaneous, multiple phase operations in one process vessel. This means less material handling and greater efficiency in less plant space, as well as better quality control throughout the process.

For a free brochure or a detailed discussion about a rental unit, or a thorough lab evaluation, contact us at:

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