CLAIMS

What is claimed is:

1. A process for improving a continuous multiphase reaction system including a solid catalyst, one or more reactants in the gas phase and one or more reactants in the liquid phase, comprising introducing a liquid phase reactant into a reactor in a targeted concentration at the inlet and at one or more downstream locations along the reactor in the axial direction of fluid flow.

2. A process for improving a continuous multiphase reaction system including a solid catalyst, one or more reactants in the gas phase and one or more reactants in the liquid phase, comprising introducing a liquid phase reactant into a reactor at the reactor inlet at a targeted concentration of the liquid phase reactant, and then introducing the liquid phase reactant into the reactor at one or more downstream locations in the axial direction of fluid flow in a concentration or concentrations greater than the targeted concentration, provided that the one or more downstream introductions do not result in a concentration of the liquid reactant within the reactor that substantially exceeds the targeted concentration.

3. ~~A~~ The process according to either of claim 1 or claim 2, wherein the effect of the one or more downstream introductions is to achieve a concentration of the liquid phase reactant within the reactor that is within thirty percent of the targeted concentration value over at least about ten percent of the length of a catalyst bed.

4. ~~A~~ The process according to claim 3, wherein the concentration of the liquid phase reactant is within thirty percent of the targeted concentration value over at least about thirty percent of the length of a catalyst bed.

5. ~~A~~ The process according to either of claim~~s~~ 1 or claim 2, further comprising introducing a gas phase reactant into the reactor at one or more downstream locations.

6. ~~A~~ The process according to either of claim~~s~~ 1 or claim 2, further comprising selecting the number of downstream introductions of the liquid phase reactant as well as the downstream locations for these introductions to provide at least a ten percent reduction in the total volume of a catalyst that is required to produce a product at a given rate of production, compared to the volume of the same catalyst that is required under the same conditions but in the absence of any downstream introductions of the liquid phase reactant.

7. ~~A~~ The process according to claim 6, wherein at least a twenty percent reduction is realized in the total catalyst requirement.

8. The~~A~~ process according to claim 7, wherein at least a thirty percent reduction is realized in the total catalyst requirement.

9. A process for reducing catalyst deactivation in a continuous multiphase reaction system including a solid catalyst, one or more reactants in the gas phase and one or more reactants in the liquid phase to the same extent as could be accomplished by diluting the concentration of a reactant or reactants in the liquid phase, but while concurrently achieving a rate of production of a desired product in excess of that which would be achieved with the use of a dilute liquid phase having a reduced concentration of the reactant or reactants, comprising introducing the reactant or reactants at the inlet and at one or more downstream locations along the reactor in the axial direction of fluid flow in a concentration that does not exceed the reduced concentration of the reactant or reactants.

10. A process for improving a semibatch, multiphase reaction system including a solid catalyst, one or more reactants in the gas phase and one or more reactants in the liquid phase, comprising introducing a liquid phase reactant at a targeted concentration at the initiation of a batch, and then making one or more later additions of the liquid phase reactant at the targeted concentration.

11. A process for improving a semibatch, multiphase reaction system including a solid catalyst, one or more reactants in the gas phase and one or more reactants in the liquid phase, comprising introducing a liquid phase reactant at a targeted concentration at the initiation of a batch, and then making one or more later additions of the liquid phase reactant at a concentration or concentrations greater than the targeted concentration.

12. The~~A~~ process according to either of claim 10 or claim 11, wherein the effect of the one or more later introductions is to maintain the concentration of the liquid phase reactant within thirty percent of the targeted concentration over at least about ten percent of the duration of a batch.

13. The~~A~~ process according to claim 12, wherein the effect of the one or more downstream introductions is to maintain the concentration of the liquid phase reactant within thirty percent of the targeted concentration over at least about thirty percent of the duration of a batch.

14. The~~A~~ process according to either of claim~~s~~ 10 or claim 11, further comprising making one or more introductions of a gas phase reactant following the initiation of a semibatch reaction.

15. The~~A~~ process according to either of claim~~s~~ 10 or claim 11, further comprising selecting the number of later introductions of the liquid phase reactant as well

as the timing for these introductions to provide at least a ten percent reduction in the total volume of a catalyst that is required to produce a certain amount of product over a plurality of batches, compared to the volume of the same catalyst that is required under the same conditions but in the absence of any later introductions of the liquid phase reactant after a batch reaction has been initiated.

16. The~~A~~ process according to claim 15, wherein at least a twenty percent reduction is realized in the total catalyst requirement.

17. The~~A~~ process according to claim 16, wherein at least a thirty percent reduction is realized in the total catalyst requirement.

18. The~~A~~ process according to any of claim~~s~~ 1, 2, 10 or 11, wherein hydrogen is a gas phase reactant.

19. The~~A~~ process according to claim 18, wherein the hydrogen is used for hydrogenation of a sugar to prepare a sugar alcohol product, for the hydrogenolysis of C-O and C-C bonds , or for hydrotreatment of hydrocarbons in petroleum refining.

20. The ~~A~~ process according to claim 19, wherein an aqueous dextrose solution is continuously hydrogenated to sorbitol.

21. The~~A~~ process according to claim 20, wherein a Raney® nickel sponge metal catalyst is used and the targeted dextrose concentration is selected in the range of from 20 to 30 percent by weight.

22. The~~A~~ process according to claim 21, wherein the targeted dextrose concentration is selected in the range of from 20 to 25 percent by weight.

23. The~~A~~ process according to claim 22, wherein the targeted dextrose concentration is 20 percent by weight.

24. A process for continuously producing sorbitol, comprising:
continuously supplying hydrogen and an aqueous dextrose feed at a first concentration to an inlet of a reactor containing a nickel sponge metal catalyst; and
continuously introducing additional supplies of the aqueous dextrose feed into the reactor at two or more downstream locations from the inlet, in each instance where at least 99.5 percent of the dextrose previously added has been reacted.

25. The ~~A~~ process according to claim 24, wherein the first concentration is between 20 and 30 percent by weight.

26. The~~A~~ process according to claim 25, wherein the first concentration is between 20 and 25 percent by weight.

27. The~~A~~ process according to claim 26, wherein the first concentration is 20 percent by weight.

28. A process for continuously producing sorbitol, comprising:
continuously supplying hydrogen and an aqueous dextrose feed at a first concentration to an inlet of a reactor containing a nickel sponge metal catalyst; and
continuously introducing additional supplies of the aqueous dextrose feed into the reactor at three or more downstream locations from the inlet, in each instance where at least 70 percent of the dextrose previously added has been reacted.

29. The~~A~~ process according to claim 28, wherein the first concentration is between 20 and 30 percent by weight.

30. The~~A~~ process according to claim 29, wherein the first concentration is between 20 and 25 percent by weight.

31. The~~A~~ process according to claim 30, wherein the first concentration is 20 percent by weight.