[0011] By contrast, high efficiency catalysts tend to exhibit relatively steep efficiency curves as a function of gas phase promoter concentration as the concentration moves away from the value that provides the highest efficiency (i.e., the change in efficiency with respect to a change in gas phase promoter concentration is at least about 0.2%/ppm when operating away from the efficiency maximizing promoter concentration). Thus, small changes in the promoter concentration can result in significant efficiency changes. The efficiency also exhibits a pronounced maximum, i.e., an optimum, at certain concentrations (or feed rates) of the gas phase promoter, when reactor pressure and feed gas composition are kept unchanged for a given reaction temperature and catalyst age. Moreover, the efficiency curves and the optimum gas phase promoter concentration tend to be strong functions of reactor temperature and are thus significantly affected if reactor temperature is varied, for example, to compensate for decreases in catalyst activity (i.e., the change in efficiency with respect to a change in reactor temperature can be at least about 0.1%/°C when operating away from the efficiency maximizing promoter concentrations for the selected temperatures). In addition, high efficiency catalysts have exhibited significant activity increases with increases in the gas phase promoter concentration in the feed, i.e., with increasing gas phase promoter concentration in the feed, temperature has to be decreased or the production rate will increase.

[0012] It has been found that under certain circumstances, silver chloride tends to irreversibly form on high-efficiency silver catalysts, causing a decline in activity and requiring more frequent catalyst replacement. While the formation of silver chloride might be expected to occur due to the addition of organic chloride promoters, in some cases the level of silver chloride formation is even greater than would normally be expected from operation with the given organic chloride promoter concentrations. Thus, a need has arisen for a process of making alkylene oxides which addresses the foregoing issues.

SUMMARY

[0013] In accordance with a first~~one~~ aspect, there is provided a process for controlling the formation of silver chloride on a high-efficiency silver catalyst used in the production of an alkylene oxide from a reactor feed gas comprising an alkylene, oxygen, and at least one organic chloride~~is~~,

~~provided. T~~the process comprisinges controlling the concentration of sulfur in the reactor feed gas on an atomic basis to no more than about 50 parts per billion (volume). Reactor feed gas sulfur concentrations of no more than about 40 ppbv are preferred, and concentrations of no more than about 30 ppbv are even more preferred. Sulfur concentrations of no more than about 20 ppbv are still more preferred. Sulfur concentrations of no more than about 10 ppbv are yet more preferred, and sulfur concentrations of no more than about 5 ppbv are further preferred. In certain especially preferred embodiments, the reactor feed gas sulfur concentration on an atomic basis is no more than about 1 ppbv. In certain exemplary embodiments, the step of controlling the concentration of sulfur in the reactor feed gas comprises selectively fluidly coupling at least one alkylene feed gas source to the process. In accordance with other examples, the step of controlling the concentration of sulfur in the reactor feed gas comprises desulfurizing an alkylene feed and/or ballast gas containing sulfur-compounds.

[0014] In accordance with a secondanother aspect, there is provided a process for manufacturing an alkylene oxide ~~is provided. The process,~~ comprising:es providing an alkylene feed comprising at least one sulfur-containing compound; removing at least a portion of the at least one sulfur-containing compound from the alkylene feed to yield a desulfurized alkylene feed;; combining the desulfurized alkylene feed with at least oxygen and at least one organic chloride to yield a reactor feed gas ~~having a~~; controlling the concentration of sulfur in the reactor feed gas ~~(~~on an atomic basis~~) of~~ to no more than about 50 ppbv;; and reacting the reactor feed gas over a high-efficiency silver catalyst to yield a reaction product comprising the alkylene oxide. In certain examples, the step of removing at least a portion of the at least one sulfur-containing compound from the alkylene feed comprises adsorbing the at least a portion of the at least one sulfur-containing compound on an adsorbent bed. In other examples, the process further comprises adjusting the adsorbent bed temperature to control the concentration of sulfur in the reactor feed gas. In further examples, the step of removing at least a portion of the at least one sulfur-containing compound from the alkylene feed comprises converting the at least a portion of the at least one sulfur-containing compound to hydrogen sulfide and adsorbing at least a portion of the hydrogen sulfide on the adsorbent bed. In additional examples, the step of removing at least a portion of the at least one sulfur-containing compound from the alkylene feed comprises scrubbing the alkylene feed with a basic compound.

[0015] In accordance with a third~~further~~ aspect, there is provided an alkylene oxide plant ~~is provided which~~, comprisinges: a desulfurizing unit having an alkylene feed gas inlet and a desulfurized alkylene gas outlet; and an alkylene oxide reactor. ~~The desulfurizing unit has an alkylene feed gas inlet and a desulfurized alkylene gas outlet. The alkylene oxide reactor~~ comprisinges a high-efficiency silver catalyst bed, a ~~desulfurized~~ reactor feed gas inlet, and an alkylene oxide product outlet, wherein the ~~desulfurized~~ reactor feed gas inlet is fluidly coupled to the desulfurized alkylene gas outlet of the desulfurizing unit, an oxygen source, and an organic chloride source., and t~~T~~he plant is configured to control the concentration of sulfur in the reactor feed gas~~produce a reactor feed having a sulfur concentration~~ on an atomic basis to~~of~~ no more than about 50 ppbv. In certain embodiments, the desulfurizing unit comprises a sulfur conversion unit fluidly coupled to a hydrogen sulfide adsorbent bed, the sulfur conversion unit comprises the alkylene feed gas inlet, and the hydrogen sulfide adsorbent bed comprises the desulfurized alkylene gas outlet. In additional examples, the alkylene oxide plant further comprises a heavy hydrocarbon contaminant pretreater comprising a heavy-hydrocarbon contaminated alkylene feed inlet and a decontaminated alkylene product outlet, wherein the decontaminated alkylene product outlet is fluidly coupled to the alkylene feed gas inlet of the desulfurizing unit.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Referring now to the drawings, illustrative embodiments are shown in detail. Although the drawings represent some embodiments, the drawings are not necessarily to scale and certain features may be exaggerated, removed, or partially sectioned to better illustrate and explain the present invention. Further, the embodiments set forth herein are exemplary and are not intended to be exhaustive or otherwise limit or restrict the claims to the precise forms and configurations shown in the drawings and disclosed in the following detailed description.

[0017] FIG. 1 is a process flow diagram depicting an embodiment of a process for making an alkylene oxide by epoxidizing an olefin which includes a desulfurizing unit;

[0018] FIG. 2a is a process flow diagram depicting an embodiment of a process for making an alkylene oxide by epoxidizing an olefin which includes a sulfur conversion unit and a hydrogen sulfide adsorbent bed;

10. The process of claim 5, wherein the step of desulfurizing the alkylene feed comprises converting at least a portion of the sulfur-containing compounds to hydrogen sulfide, and adsorbing at least a portion of the hydrogen sulfide on the adsorbent bed.

11. A process for manufacturing an alkylene oxide, comprising:

providing an alkylene feed comprising at least one sulfur-containing compound;

removing at least a portion of the at least one sulfur-containing compound from the alkylene feed to yield a desulfurized alkylene feed;

combining the desulfurized alkylene feed with at least oxygen and at least one organic chloride to yield a reactor feed gas;

controlling the concentration of sulfur in the reactor feed gas on an atomic basis to no more than about 50 ppbv; and

reacting the reactor feed gas over a high efficiency silver catalyst to yield a reaction product comprising the alkylene oxide.

12. The process of claim 11, further comprising adjusting the rate of removal of the at least a portion of the at least one sulfur-containing compound from the alkylene feed to control the concentration of sulfur in the reactor feed gas.

13. The of claim 11, wherein the step of removing at least a portion of the at least one sulfur-containing compound from the alkylene feed comprises adsorbing the at least a portion of the at least one sulfur-containing compound on an adsorbent bed.

14. The process of claim 13, wherein the step of controlling the concentration of sulfur in the reactor feed gas comprises adjusting an adsorbent bed temperature.

15. An alkylene oxide plant, comprising:

a desulfurizing unit having an alkylene feed gas inlet and a desulfurized alkylene gas outlet; and

an alkylene oxide reactor comprising a high efficiency silver catalyst bed, a reactor feed gas inlet, and an alkylene oxide product outlet, wherein the reactor feed gas inlet is fluidly coupled to the desulfurized alkylene gas outlet of the desulfurizing unit, an