in gas phase promoter concentration is at least about 0.2%/ppmv when operating away from the selectivity maximizing promoter concentration). Thus, small changes in the promoter concentration can result in significant selectivity changes, and the selectivity 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.

[0008] For a high selectivity catalyst, at any given production rate and set of operating conditions, a temperature (T) and overall catalyst chloriding effectiveness (Z*) combination exists that results in optimum actual selectivity. As the catalyst ages, for a fixed production rate target, temperature (T) and Z* are increased to maintain activity, meet the production rate target, and achieve optimum selectivity. At a constant production rate, the general practice is to monitor actual selectivity response with Z* and optimize it. However, when an ethylene oxide plant operates at varying production rates, determining whether the catalyst has reached optimal selectivity is challenging.

[0009] There is a need for keeping the ethylene oxide process operating at optimal selectivity as changes are made to the value of an ethylene oxide production parameter.

SUMMARY

[0010] The present disclosure provides a method of operating a process for producing ethylene oxide by reacting a feed gas comprising ethylene, oxygen, and at least one organic chloride over a high selectivity, silver-based catalyst comprising rhenium using scaled selectivity values is provided. The method comprises the steps of operating the process at a first value of a reaction temperature, a first value of an overall catalyst chloriding effectiveness, and a first set of values for a set of reference operating conditions, the set of reference operating conditions comprising a plurality of reference reaction parameters, to yield a first value of a target ethylene oxide production parameter and a first actual selectivity value. The method also comprises operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, to yield a second value of the target ethylene oxide production parameter and a second actual selectivity value. The method further comprises calculating a scaled second

selectivity value from the second actual selectivity value, a value in the second set of values of at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the at least one of the reference operating conditions in the set of reference operating conditions. In addition, a determination is made that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness based on the scaled second selectivity value and the first actual selectivity value. The method comprises subsequently adjusting at least one of the reaction temperature to a third reaction temperature value and/or the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value, such that the scaled selectivity increases. In certain examples, the method further comprises calculating a scaled first selectivity value from the first actual selectivity value, a value in the first set of values of the at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the at least one of the reference operating conditions in the set of reference operating conditions, wherein the step of determining that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness is based on the scaled second selectivity value and the scaled first selectivity value.

[0010a] In one aspect, there is provided a method of operating a process for producing ethylene oxide by reacting a feed gas comprising ethylene, oxygen, and at least one organic chloride over a high selectivity, silver-based catalyst comprising rhenium, the method comprising the steps of:

operating the process at a first value of a reaction temperature, a first value of an overall catalyst chloriding effectiveness, and a first set of values for a set of reference operating conditions, wherein the set of reference operating conditions comprises a plurality of reference reaction parameters and does not include activity, to yield a first value of a target ethylene oxide production parameter and a first actual selectivity value;

operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, to yield a second value of the target ethylene oxide production parameter and a second actual selectivity value;

calculating a scaled second selectivity value from the second actual selectivity, a value in the second set of values of at least one of the reference operating conditions in the set of

reference operating conditions, and a reference value of the at least one of the reference operating conditions in the set of reference operating conditions;

determining that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness based on the scaled second selectivity value and the first actual selectivity value, and subsequently

adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value, such that the scaled selectivity increases.

[0011] The disclosure further provides a method of operating a process for producing ethylene oxide by reacting a feed gas comprising ethylene, oxygen, and at least one organic chloride over a high selectivity, silver-based catalyst comprising rhenium using scaled selectivity values and scaled reaction temperature values is provided. The method comprises operating the process at a first value of a reaction temperature, a first value of an overall catalyst chloriding effectiveness, and a first set of values for a set of reference operating conditions, the set of reference operating conditions comprising a plurality of reference reaction parameters, to yield a first value of a target ethylene oxide production parameter and a first actual selectivity value. The method further comprises subsequently operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, to yield a second value of the target ethylene oxide production parameter and a second actual selectivity value. The method also comprises calculating a scaled first selectivity value from the first actual

selectivity value, a value in the first set of values of a first at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the first at least one of the reference operating conditions in the set of reference operating conditions, as well as calculating a scaled second selectivity value from the second actual selectivity value, a value in the second set of values of the first at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the first at least one of the reference operating conditions in the set of reference operating conditions. In addition, the method comprises calculating a scaled first reaction temperature value from the first value of the reaction temperature, a value in the first set of values of a second at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the second at least one of the reference operating conditions in the set of reference operating conditions, as well as calculating a scaled second reaction temperature value from the second value of the reaction temperature, a value in the second set of values of the second at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the second at least one of the reference operating conditions in the set of reference operating conditions. A determination is made that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness by comparing the scaled first selectivity to the scaled second selectivity. The method comprises subsequently adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value such that the scaled selectivity increases, wherein the step of subsequently adjusting is based on the first scaled selectivity value, the second scaled selectivity value, the first scaled reaction temperature, and the second scaled reaction temperature.

[0011a] In another aspect, there is provided a method of operating a process for producing ethylene oxide by reacting a feed gas comprising ethylene, oxygen, and at least one organic chloride over a high selectivity, silver-based catalyst comprising rhenium, the method comprising the steps of:

operating the process at a first value of a reaction temperature, a first value of an overall catalyst chloriding effectiveness, and a first set of values for a set of reference operating conditions, wherein the set of reference operating conditions comprises a plurality of reference

reaction parameters and does not include activity, to yield a first value of a target ethylene oxide production parameter and a first actual selectivity value;

subsequently operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, to yield a second value of the target ethylene oxide production parameter and a second actual selectivity value;

calculating a scaled first selectivity value from the first actual selectivity value, a value in the first set of values of a first at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the first at least one of the reference operating conditions in the set of reference operating conditions;

calculating a scaled second selectivity value from the second actual selectivity value, a value in the second set of values of the first at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the first at least one of the reference operating conditions in the set of reference operating conditions;

calculating a scaled first reaction temperature value from the first value of the reaction temperature, a value in the first set of values of a second at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the second at least one of the reference operating conditions in the set of reference operating conditions;

calculating a scaled second reaction temperature value from the second value of the reaction temperature, a value in the second set of values of the second at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the second at least one of the reference operating conditions in the set of reference operating conditions;

determining that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness by comparing the scaled first selectivity to the scaled second selectivity; and

subsequently adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value, such that the scaled selectivity increases, wherein the step of

subsequently adjusting is based on the first scaled selectivity value, the second scaled selectivity value, the first scaled reaction temperature, and the second scaled reaction temperature.

BRIEF DESCRIPTION OF THE FIGURES

[0012] FIG. 1 depicts a plot of the scaled selectivity, actual selectivity, and production rate for a high selectivity silver-based catalyst comprising rhenium for a 10 day period;

THE CLAIMS

What is claimed is:

1. A method of operating a process for producing ethylene oxide by reacting a feed gas comprising ethylene, oxygen, and at least one organic chloride over a high selectivity, silver-based catalyst comprising rhenium, the method comprising the steps of:

operating the process at a first value of a reaction temperature, a first value of an overall catalyst chloriding effectiveness, and a first set of values for a set of reference operating conditions, wherein the set of reference operating conditions comprises a plurality of reference reaction parameters and does not include activity, to yield a first value of a target ethylene oxide production parameter and a first actual selectivity value;

operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, to yield a second value of the target ethylene oxide production parameter and a second actual selectivity value;

calculating a scaled second selectivity value from the second actual selectivity, a value in the second set of values of at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the at least one of the reference operating conditions in the set of reference operating conditions;

determining that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness based on the scaled second selectivity value and the first actual selectivity value, and subsequently

adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value, such that the scaled selectivity increases.

2. The method of claim 1, wherein the step of calculating a scaled second selectivity value from the second actual selectivity, the value in the second set of values of at least one of the

reaction temperature value using a reaction temperature scaling relationship selected from the group consisting of a linear relationship and a non-linear relationship.

11. The method of claim 9, further comprising the step of calculating a scaled first reaction temperature value from the first value of the reaction temperature, a value in the first set of values of the second at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the second at least one of the reference operating conditions in the set of reference operating conditions, wherein the step of adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value is further based on the scaled second reaction temperature and the scaled first reaction temperature value.

12. The method of claim 11, wherein the step of operating the process at a first value of the reaction temperature, a first value of the overall catalyst chloriding effectiveness, and a first set of values for the set of reference operating conditions occurs before the step of operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, the scaled second selectivity is less than the scaled first selectivity by more than a first predetermined value, the scaled second reaction temperature value is lower than the scaled first reaction temperature value by more than a second predetermined value, and the step of adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst chloriding effectiveness value comprises at least one of increasing the reaction temperature to the third reaction temperature value and decreasing the overall catalyst chloriding effectiveness to the third overall catalyst chloriding effectiveness value.

13. A method of operating a process for producing ethylene oxide by reacting a feed gas comprising ethylene, oxygen, and at least one organic chloride over a high selectivity, silver-based catalyst comprising rhenium, the method comprising the steps of:

operating the process at a first value of a reaction temperature, a first value of an overall catalyst chloriding effectiveness, and a first set of values for a set of reference operating conditions, wherein the set of reference operating conditions comprises a plurality of reference reaction

parameters and does not include activity, to yield a first value of a target ethylene oxide production parameter and a first actual selectivity value;

subsequently operating the process at a second value of the reaction temperature, a second value of the overall catalyst chloriding effectiveness, and a second set of values for the set of reference operating conditions, to yield a second value of the target ethylene oxide production parameter and a second actual selectivity value;

calculating a scaled first selectivity value from the first actual selectivity value, a value in the first set of values of a first at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the first at least one of the reference operating conditions in the set of reference operating conditions;

calculating a scaled second selectivity value from the second actual selectivity value, a value in the second set of values of the first at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the first at least one of the reference operating conditions in the set of reference operating conditions;

calculating a scaled first reaction temperature value from the first value of the reaction temperature, a value in the first set of values of a second at least one of the reference operating conditions in the set of reference operating conditions, and a reference value of the second at least one of the reference operating conditions in the set of reference operating conditions;

calculating a scaled second reaction temperature value from the second value of the reaction temperature, a value in the second set of values of the second at least one of the reference operating conditions in the set of reference operating conditions, and the reference value of the second at least one of the reference operating conditions in the set of reference operating conditions;

determining that an adjustment is required to at least one of the reaction temperature and the overall catalyst chloriding effectiveness by comparing the scaled first selectivity to the scaled second selectivity; and

subsequently adjusting at least one of the reaction temperature to a third reaction temperature value and the overall catalyst chloriding effectiveness to a third overall catalyst