when operating these catalysts as double bond isomerization catalysts alone for the production of the terminal olefin from the interior olefin.

[0005] Some attempts have been made to improve the performance of magnesium oxide catalysts. For example, U.S. Patent No. 6,875,901 discloses improvements to the deactivation rate of magnesium oxide isomerization catalysts by limiting certain impurities, such as phosphorous, sulfur, transition metals, etc. Deactivation in the presence of oxygenates, however, remains problematic.

SUMMARY OF THE CLAIMED EMBODIMENTS

[0006] Catalysts have now been found that may be used in isomerization and/or combined isomerization / metathesis processes that are tolerant to poisons that may be present in the feed, including oxygenates.

[0007] ~~In one aspect, e~~Embodiments disclosed herein relate to a process for the double-bond isomerization of olefins, the process including: contacting a fluid stream comprising olefins with a fixed bed comprising an isomerization catalyst, that is tolerant to oxygenate poisons, to convert at least a portion of the olefin to its isomer. In an aspect, there is provided a process for the isomerization of olefins, the process comprising: contacting in a reaction zone at least one olefin-containing feed with a catalyst having activity for the double bond isomerization of the olefin to form an isomerized olefin product, wherein the catalyst comprises a γ-alumina-titania catalyst having a surface area of greater than 200 m^2/g. In another aspect, there is provided a catalyst useful for the double-bond isomerization of olefins, comprising a γ-alumina-titania mixture having a surface area of greater than 200 m^2/g.

[0008] ~~In another aspect, e~~Embodiments disclosed herein relate to a process for the double-bond isomerization of olefins, and simultaneous dehydration of alcohols. The simultaneous isomerization and dehydration may occur with a single catalyst and may occur in one or more reactors or reactor beds.

[0009] ~~In another aspect, e~~Embodiments disclosed herein relate to a process for the production of propylene, including: fractionating a hydrocarbon stream comprising n-butenes, isobutene, paraffins, and alcohols into at least two fractions including a light C_4 fraction comprising isobutene and a heavy C_4 fraction comprising n-butenes and paraffins; feeding ethylene and the heavy C_4 fraction to a fixed bed reactor comprising a metathesis catalyst and an isomerization catalyst, that is tolerant to

oxygenate poisons, contacting the heavy C_4 fraction with the isomerization catalyst to convert at least a portion of the 1-butene to 2-butene while converting at least a portion of alcohols into additional olefins; and contacting ethylene and at least a portion of the 2-butene with a metathesis catalyst to form a metathesis product comprising propylene, paraffins, any unreacted ethylene, any unreacted alcohols, and any unreacted 1-butene and 2-butene.

In yet another aspect, there is provided a system for the production of olefins, the system comprising: an inlet for receiving an olefin-containing hydrocarbon feed; a reaction zone comprising at least one bed of catalyst, the at least one bed containing a γ-alumina-titania catalyst having a surface area of greater than 200 m^2/g and having activity for the double bond isomerization of the olefin to form an isomerized olefin product; and an outlet for recovering an effluent comprising the isomerized olefin product.

[0010] Other ~~aspects~~ embodiments and advantages will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0011] Figure 1 is a simplified process flow diagram of a process for isomerization and metathesis using catalysts according to embodiments disclosed herein.

[0012] Figure 2 is a simplified process flow diagram of a process for isomerization and metathesis using catalysts according to embodiments disclosed herein.

[0013] Figure 3 is a simplified process flow diagram of a process for isomerization and metathesis using catalysts according to embodiments disclosed herein.

[0014] Figure 4 is a simplified process flow diagram of a process for isomerization and metathesis using catalysts according to embodiments disclosed herein.

[0015] Figure 5 is a simplified process flow diagram of a process for isomerization and metathesis using catalysts according to embodiments disclosed herein.

DETAILED DESCRIPTION

[0016] Embodiments disclosed herein provide an alumina-based isomerization catalyst that exhibits little or no oxygenate poisoning. The catalyst may be a γ-alumina-titania crystalline mixture including active sites that catalyze the positional isomerization of olefins. In some embodiments, the alumina-titania catalyst may have a composition of titanium with a lower limit of 0.01, 1, 2, 3, 4, 5, 10, 15, 20, or 25 to an upper limit of 15, 20, 25, 30, 35, 40, 45, or 50 wt%, where any lower limit may be combined with any upper limit. Other aspects of the γ-alumina-titania catalyst are described below.

[0017] γ-Alumina-titania catalysts herein may also have active sites for catalyzing the dehydration of alcohols. That is, the catalyst may have a dual activity that allows the catalyst to dehydrate alcohols, producing additional olefins, as well as facilitating the double bond isomerization of the olefins. While certain aspects will be described herein in terms of the alumina-titania catalysts, it should be understood that various other dual activity catalysts are also contemplated as being within the scope of embodiments disclosed herein.

[0018] As described herein, the alumina-titania catalyst being used for the dual purpose of double bond isomerization and alcohol dehydration is an improvement upon traditional basic metal oxide catalysts because it does not lose activity in the presence of oxygenates, such as ethers, alcohols, and water. Additionally, it has been found to