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(54) **CATALYTIC DEHYDRATION OF ALCOHOLS USING NON-VOLATILE ACID CATALYSTS**

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CPC **C07C 1/24** (2013.01); **C07C 2529/40** (2013.01); **C07C 2529/83** (2013.01); **C07C 2529/84** (2013.01); **C07C 2529/85** (2013.01)

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,967,897 A 1/1961 Sharp et al.
4,396,789 A 8/1983 Barrocas et al.

(Continued)

FOREIGN PATENT DOCUMENTS

EP 0 712 824 A1 5/1996
WO 88/02361 A1 4/1988

(Continued)

OTHER PUBLICATIONS

International Search Report and Written Opinion of International Application No. PCT/US2010/043650, dated Sep. 16, 2010.

(Continued)

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(57) **ABSTRACT**

A catalytic process for dehydration of an aliphatic C₂-C₆ alcohol to its corresponding olefin is disclosed. The process continuously flows through a reaction zone a liquid phase containing an aliphatic C₂-C₆ alcohol to contact a non-volatile acid catalyst at a reaction temperature and pressure to at least partially convert the aliphatic C₂-C₆ alcohol in the liquid phase to its corresponding olefin. The reaction pressure is greater than atmospheric pressure and the reaction temperature is above the boiling point of the olefin at reaction pressure, but below the critical temperature of the alcohol, and the olefin product is substantially in the gaseous phase. After the contacting step, the olefin containing gaseous phase is separated from the liquid phase. The invention also relates to catalytic processes such as a hydrolysis of an olefin to an alcohol, an esterification, a transesterification, a polymerization, an aldol condensation or an ester hydrolysis.

16 Claims, 1 Drawing Sheet

