diffusion resistance and high activity for the isomerization of xylenes while minimizing xylene loss to transmethylation reactions.

BRIEF SUMMARY ~~OF THE INVENTION~~

The present ~~invention~~ disclosure provides boroaluminosilicate molecular sieves for use as xylene isomerization catalysts. Such boroaluminosilicate molecular sieves have surprisingly been found to exhibit unexpectedly high xylene isomerization activity while simultaneously yielding less transmethylation byproducts (C_7 and C_9 aromatics) compared to industry standard catalysts. Also provided are methods for use of these boroaluminosilicate molecular sieves for enriching the p-xylene content of a hydrocarbon-containing feed stream comprising xylene isomers. Such catalysts include boroaluminosilicate molecular sieves that can be prepared, for example, in substantially H^+-form through the use of an organic base, eliminating the need for a cation exchange step to remove alkali metal which can degrade isomerization performance.

In one aspect, the disclosure provides a boroaluminosilicate molecular sieve having an average crystallite size less than 2 μm.

Accordingly, in one ~~aspect~~embodiment, the ~~invention~~ disclosure provides the hydrogen form of boroaluminosilicate molecular sieves having an average crystallite size less than 2 μm.

In another aspect, the disclosure provides a method for increasing the proportion of p-xylene (pX) in a hydrocarbon-containing feed stream comprising xylene isomers, said method comprising contacting the hydrocarbon-containing feed stream with an isomerization catalyst described herein and under conditions suitable to yield a stream enriched in p-xylene with respect to the hydrocarbon-containing feed stream.

In another aspect, the ~~invention~~ disclosure provides a methods for increasing the proportion of p-xylene (pX) in a hydrocarbon-containing feed stream comprising xylene isomers, said method comprising contacting the hydrocarbon-containing feed stream with an isomerization catalyst under conditions suitable to yield a stream enriched in p-xylene with respect to the hydrocarbon-containing feed stream, wherein the isomerization catalyst comprises a boroaluminosilicate molecular sieve prepared using an amine base.

In another aspect, the ~~invention~~ disclosure provides a catalyst systems for enriching a xylene isomers feed in p-xylene comprising a first bed comprising an ethylbenzene (EB) conversion catalyst and a second bed comprising an isomerization catalyst that comprises a boroaluminosilicate molecular sieve.

In another aspect, the ~~invention~~ disclosure provides a xylene isomerization reactor having a reaction zone containing a catalyst system as described above.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a is a flow diagram illustrating one illustrative embodiment of a method for xylene isomerization.

Figure 1b is a flow diagram illustrating another illustrative embodiment of a method for xylene isomerization.

Figure 1c is a flow diagram illustrating a third illustrative embodiment of a method for xylene isomerization.

43. The catalyst system of any one of claims 35-42, wherein the EB conversion catalyst comprises an AI-MFI molecular sieve or a ZSM-5-type molecular sieve.

44. The catalyst system of any one of claims 35-43, wherein the isomerization catalyst further comprises a support.

45. The catalyst system of claim 44, wherein the support comprises alumina, silica, titania, or a mixture thereof.

46. The catalyst system of claim 45, wherein the support comprises silica.

47. The catalyst system of claim 45, wherein the support comprises titania.

48. The catalyst system of claim 45, wherein the support comprises alumina.

49. The catalyst system of claim 45, wherein the support comprises a mixture of alumina and silica.

50. The catalyst system of any one of claims 35-49, wherein the first bed is disposed over the second bed.

51. The catalyst system of claim 50, wherein a guard bed comprising a hydrogenation catalyst component is disposed over the first bed.

52. The catalyst system of claim 50, wherein a guard bed comprising a hydrogenation catalyst component is disposed between the first bed and the second bed.

53. A xylene isomerization reactor comprising a reaction zone containing a catalyst system of any one of claims 35-52.

54. The method of any of claims ~~15~~-34, wherein the isomerization catalyst further comprises a hydrogenation catalyst component.

55. The catalyst system of any of claims 35-50, further comprising a hydrogenation catalyst component.

56. The method of any of claims ~~15~~-34 and 54, wherein the isomerization catalyst has an aluminum content of 0.01 wt% to 3.3 wt%.

57. The method of any of claims ~~15~~-34 and 54-56, wherein the isomerization catalyst has a boron content of 0.01wt% to 2.0wt%.