Other examples of ionic liquids and their methods of preparation may also be found in U.S. Patent Nos. 5,731,101; 6,797,853 and in U.S. Patent Application Publications 2004/0077914 and 2004/0133056.

Hydrogenation in chloroaluminate ionic liquids in the presence of an electropositive metal and HCl was reported by K. R. Seddon et al in *Chem. Commun.*, 1999, 1043-1044.

As a result of use, ionic liquid catalysts become deactivated, i.e. lose activity, and may eventually need to be replaced. However, ionic liquid catalysts are expensive and replacement adds significantly to operating expenses by in some cases requiring shut down of an industrial process. One of the heretofore unsolved problems impeding the commercial use of chloroaluminate ionic liquid catalysts has been the inability to regenerate and recycle them. The present invention provides methods to regenerate acidic chloroaluminate ionic liquid catalysts overcoming this obstacle and paving the way for the practical, commercial use of these environmentally friendly catalysts.

SUMMARY OF THE DISCLOSURE~~INVENTION~~

Among other things the present disclosure~~invention~~ provides a process for regenerating a used acidic catalyst which has been deactivated by conjunct polymers by removing the conjunct polymers so as to increase the activity of the catalyst. Methods for removing the conjunct polymers include, but are not limited to, hydrogenation, addition of a basic reagent and alkylation. The methods are applicable to all acidic catalysts and are described with reference to certain ionic liquid catalysts.

In a first aspect, there is provided a process for regenerating a used acidic ionic liquid catalyst which has been deactivated by conjunct polymers by removing the conjunct polymers by hydrogenation so as to increase the activity of the catalyst.

In a second aspect, there is provided a process for regenerating a used acidic ionic liquid catalyst which has been deactivated by conjunct polymers by removing the conjunct polymers by alkylation so as to increase the activity of the catalyst.

In a third aspect, there is provided a process for regenerating a used acidic H_2SO_4 catalyst which has been deactivated by conjunct polymers by removing the conjunct polymers so as to increase the activity of the used acidic H_2SO_4 catalyst.

In a fourth aspect, there is provided a process for regenerating a used acidic ionic liquid catalyst which has been deactivated by complexation with conjunct polymers by freeing the conjunct polymers from complexation so as to increase the activity of the catalyst.