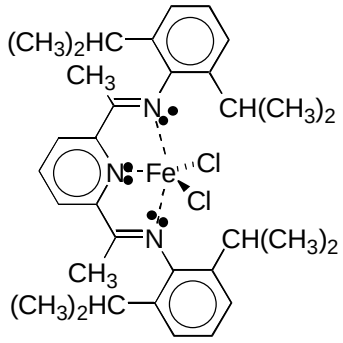
Iron and Cobalt Based Olefin Polymerization Catalysts (97/98S9).

A new family of single-site olefin polymerization catalysts, based on iron and cobalt complexes, has been developed. These complexes, bearing 2,6-bis(imino)pyridyl ligands are highly active, producing linear high density polyethylene. The catalysts also show activity for the preparation of polypropylenes, other polyolefins, and copolymers incorporating both nonpolar and polar monomers such as styrene, methyl acrylate, methyl methacrylate, butyl acrylate, acrylonitrile and vinyl acetate. A typical iron complex is shown below.

FIGURE I.B.2
TYPICAL PYRIDYL BISMINE COMPLEXES



This family of catalysts has been independently discovered by groups of chemists in the U.S. and Great Britain and in view of the high polymerization rate and yield bears great commercial potential.

These developments in iron and cobalt complexes follow from a significant development in late transition metal polymerization technology, reported in 1995 by Brookhart and co-workers who showed that catalysts based on nickel and palladium could be used for the production of a range of linear and branched polyethylenes.

In contrast to the nickel and palladium complexes which produce highly branched polyolefin structures, yet at modest levels of activity, iron and cobalt catalysts produce highly linear polyethylene at productivities which can be comparable with the most active metallocene catalysts. Specifically, the iron based compounds exhibit markedly higher activities than the cobalt compounds, and these are believed to offer the best commercial potential.

Development of these exciting new compounds has been carried out by teams lead by Dr Maurice Brookhart at the University of North Carolina at Chapel Hill, sponsored by DuPont, and independently in parallel by a group led by professor Vernon Gibson at Imperial College, London, working with BP Research. Both groups have published papers and DuPont and BP Chemicals have filed patents relating to these materials.

The global market for HDPE approached 20 million tons in 1998 and is forecast to grow at between 5 and 6 percent annually to give a global consumption doubling to almost 40 million tons per year by 2010. Catalyst consumption increases in line with polymer production, less a factor for productivity (catalyst activity) improvements.

To place a value on this market, taking a typical catalyst cost of say $15 per ton of product polymer, gives a total global market of $300 million per year in 1998, and set to almost double by 2010. Over and above this there is the prospect of developing applications in other fields including polypropylene and copolymers.

The opportunities to produce whole new families of copolymers with as yet unknown properties could lead to vastly larger markets still.