Gesellschaft Deutscher Chemiker
Ortsverband Bonn

Breaking it and fixing it: new chemistry with nitrogen

Professor Dr. Patrick Holland, Yale University

Wednesday**, March 22

5 pm (17 Uhr s.t.) in **Hörsaal 2**

Atmospheric N_2 is a cheap, abundant resource with great potential for energy storage and chemical synthesis, but it is difficult to convert it into other compounds ("fixing" nitrogen). This seminar will describe the challenges and opportunities of nitrogen fixation, as well as my students' discoveries of how to break the N–N bond of N_2 using homogeneous transition-metal complexes. In addition to new catalysts for producing ammonia, we have identified a new mechanism for sequential C-H activation and N-N activation to create C-N bonds. Detailed mechanistic studies reveal a cyclic reaction, which gives a route from atmospheric N_2 and petroleum-derived arenes to substituted anilines. This is an important step toward preparing useful chemicals using air as a starting material.

Patrick Holland was trained at Princeton University (A.B. 1993), University of California at Berkeley (Ph.D. 1997 with Robert Bergman and Richard Andersen), and University of Minnesota (postdoc 1997-2000 with William Tolman). His independent research at the University of Rochester initially focused on the properties and reactions of three-coordinate complexes of iron and cobalt. Since then, his research group has broadened its studies to iron-N_2 chemistry, reactive metal-ligand multiple bonds, iron-sulfur clusters, engineered metalloproteins, redox-active ligands, solar H_2 production, and the mechanisms of organometallic transformations at base metal complexes. In 2013, Prof. Holland moved to Yale University, where he is now Whitehead Professor of Chemistry. His research has been recognized with a number of awards, and election as a Fellow of the American Association for the Advancement of Science. In N_2 reduction, his group has established molecular principles through which iron species are able to weaken and break the N-N bond, and has been a leader in iron chemistry relevant to the iron-molybdenum cofactor of nitrogenase.