

CCST Seminar:

- › Wednesday, February 18, 2009
- › 1:30 P.M.
- › 366 Colburn Laboratory

Prof. Dr. Roel Prins

Institute for Chemical and Bioengineering ETH Zurich, Switzerland

Roel Prins studied at the Univ. of Amsterdam and worked 10 years in the Shell Laboratories in Amsterdam and Emeryville, USA. From 1977-1987 he was professor of Inorganic Chemistry at the Technical University in Eindhoven and spent a sabbatical year (1986/87) in Berkeley with Prof. Gabor Somorjai. From 1987-2006 he was professor of catalysis at the ETH in Zurich and investigated hydrodesulfurization and hydrodenitrogenation, the use of zeolites in catalysis, and EXAFS. He is corresponding member of the Royal Dutch Academy of Sciences and president of the Federation of European Catalysis Societies. He chaired the Dutch synchrotron radiation committee and was a member of the Swiss-Norwegian synchrotron radiation committee and the Scientific Advisory Committee for the Swiss Light Source. He was editor-in-chief of the *Journal of Catalysis* and is now editor responsible for Asia. He was Schuit lecturer at UD, Ipatieff lecturer at Northwestern University, guest professor at the Technical University in Delft and the Pierre et Marie Curie University in Paris, and has been a guest professor at the Dalian University of Technology in China since 2006.

“Metal Phosphides and Metal on Mesoporous Zeolites as New Catalysts for Hydrodesulfurization of Fuels”

Many countries are introducing more severe legislation for the maximum allowed level of sulfur in fuels; therefore, extensive research is being carried out to find better catalysts than the classic sulfided Mo catalysts, promoted by Co or Ni. We have developed metal phosphides and noble metal on mesoporous zeolites as catalysts for hydrodesulfurization (HDS). Metal phosphides are excellent catalysts for HDS and hydrodenitrogenation, but the usual method of preparation, reduction of metal and phosphate salts at high temperature, leads to sintering and loss of activity. Therefore, we used phosphine to prepare metal phosphides at lower temperature. Reduction of metal salts with hypophosphite, of metal oxides in a hydrogen plasma, and of metal sulfides and phosphate by hydrogen also led to excellent catalysts. PtPd alloy catalysts on amorphous silica-alumina (ASA) are more active than Pt and Pd on alumina, because alloy particles on an acidic support have lower sulfur sensitivity and thus higher activity than Pt and Pd particles on a non-acidic support. Zeolites have an even higher acidity than ASA, but have too narrow pores to allow molecules such as 4,6-dialkyl-dibenzothiophene to reach the acid sites inside the micropores. We, therefore, synthesized mesoporous ZSM-5, Beta, and Mordenite and confirmed that the resulting materials have mesopores and good acidity by means of the isomerization of 2-methyl-2-pentene and the alkylation of benzene by benzylalcohol. Pt, Pd, and PtPd catalysts made from these mesoporous zeolites showed excellent HDS properties, with higher activity than ASA-based catalysts. These HDS catalysts might find use in the second stage of an HDS process.