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1. Main Research Results

1) Niobic acid, $Nb_2O_5 \cdot nH_2O$, has been studied as a heterogeneous Lewis acid catalyst. NbO_4 tetrahedra, Lewis acid sites, on $Nb_2O_5 \cdot nH_2O$ surface immediately form NbO_4-H_2O adducts in the presence of water. However, a part of the adducts can still function as effective Lewis acid sites, catalyzing the allylation of benzaldehyde with tetraallyl tin and the conversion of glucose into 5-(hydroxymethyl)furfural in water.
2) Protonated titanate nanotubes are demonstrated to function as a highly active solid acid catalyst for the Friedel-Crafts alkylation reaction even near room temperature. The high catalytic activity for the reaction can be attributed to the unique nanotube structure, which contains both Brønsted and Lewis acid sites.

2. List of Publications

1) "$Nb_2O_5 \cdot nH_2O$ as a heterogeneous catalyst with water-tolerant Lewis acid sites" K.Nakajima, Y.Baba, M.Kitano, J.N.Kondo, S.Hayashi, M.Hara, *J.Am.Chem.Soc.*, 133, 4224-4227(2011).
2) "Protonated Titanate Nanotubes as Solid Acid Catalyst", M.Kitano, K.Nakajima, J.N.Kondo, S.Hayashi, M.Hara, *J.Am.Chem.Soc.*, **132**, 6622-6623(2010).
3) "Structure and Catalysis of Mesoporous Nb_2O_5", K.Nakajima, T.Fukui, H.Kato, M.Kitano, S.Hayashi, M.Hara, *Chem.Mater.*, **22**, 3332-3339(2010).
4) * "Biodiesel Production by Amorphous Carbon Bearing SO_3H, COOH and Phenolic OH Groups, a Solid Bronsted Acid Catalyst", M.Hara, *Topics in Catalysis*, 53, 805-810(2010).
5) * "Biomass conversion by a solid acid catalyst", M.Hara, *Energy & Environmental Science*, **3**, 601-607(2010).
6) "Nanosheets as highly active solid acid catalysts for green chemical syntheses", A.Takagaki, K.Tagusagawa, S.Hayashi, M.Hara, K.Domen, *Energy & Environmental Science*, **3**, 82-93(2010).

3. List of Invited Presentations

1) Michikazu Hara, "Plenary Lecture: Environmentally benign chemical production by a solid Brønsted acid", 6th International Conference on Environmental Catalysis (ICEC 2010), September 12-15, 2010, Beijing, China.

2) Michikazu Hara, “Invited Lecture: Environmentally benign production of biodiesel by a solid acid catalyst”**, Pacifichem 2010,** December 15 - 20, 2010, Honolulu, Hawaii, USA.

3) Michikazu Hara, “Invited Lecture: Solid acid catalysis”**, Pacifichem 2010,** December 15 - 20, 2010, Honolulu, Hawaii, USA.

4) Michikazu Hara, “Invited Lecture: Conversion of cellulosic biomass into sustainable chemicals on heterogeneous acid catalysts”**,** The 1st International Symposium on Chemistry of Energy Conversion and Storage**,** Feb.28-Mach 3, 2011, Berlin, BRD.