PALLADON LIGAND ADVANCES AMMONIA COUPLING

Palladium-catalyzed cross-coupling of aryl halides and amines, known as Buchwald-Hartwig ammination, is a key tool for constructing amines in organic synthesis. In the latest twist on this reaction, Mark Stradiotto and coworkers at Dalhousie University, in Halifax, Nova Scotia, report a new ligand that enables chemists to selectively react ammonia—the simplest and most abundant N-H source—with a broad range of aryl halides and tosylates at room temperature (Angew. Chem. Int. Ed., DOI: 10.1002/anie.201000526). The chelating PNN ligand, which the team calls Mor-DalPhos, consists of an adamantyl-substituted phosphoramidite and a morpholine-substituted nitrogen bridged by phenylene. The team previously prepared a dimethyl version of the ligand, called Me-DalPhos, which is handy for traditional amine couplings (Chem. Eur. J. 2010, 16, 1987). Both Mor-DalPhos and Me-DalPhos are in demand by pharmaceutical companies.

Stradiotto says his group has made batches of the ligands that are already being sold by Strem Chemicals. The reactivity and selectivity of Mor-DalPhos with ammonia at room temperature “is remarkable,” says John F. Hartwig of the University of Illinois, Urbana-Champaign. Stradiotto’s group has found a ligand “sweet spot” for C-N coupling between tightly bound bidentate bisphosphines and labile hindered monodentate phosphines, Hartwig notes.

DENSITY ANALYSIS BY MAGNETIC LEVITATION

Using the magic of magnetic levitation, Harvard University chemists have devised a simple, inexpensive, and portable tool for food and water analysis based on density (J. Agric. Food Chem., DOI: 10.1021/jf103777n). Magnetic levitation, or MagLev, uses magnetic fields to suspend objects. The phenomenon can be applied to measure density and estimate chemical composition on the basis of differences in density. Katherine A. Mirica, Scott T. Phillips, Charles R. Maes, and George M. Whitesides designed a MagLev device that consists of a vial containing a paramagnetic fluid—GdCl₃, for example—between two NdFeB magnets. By suspending a diamagnetic object or droplet of sample fluid in the paramagnetic solution, the researchers were able to estimate the salinity of water, distinguish different plant oils according to their content of polyunsaturated and monounsaturated fats, determine fat content in milk, cheese, and peanut butter; and compare a variety of grains. “Potential applications of MagLev may include evaluating the suitability of water for drinking or irrigation, assessing the content of fat in foods and beverages, and studying processing of grains,” the researchers note.

RAPID WATER-ION DYNAMICS REVEALED

New spectroscopic techniques are providing some of the most detailed pictures yet of the behavior of water molecules on femtosecond timescales (Science 2010, 329, 1003 and 1006). Ubiquitous liquid water, with its networks of evanescent hydrogen bonds and its vital interactions with biological and atmospheric molecules and ions, remains mysterious. In one study, Min-Joo Li of the SLAC National Accelerator Laboratory and colleagues used two-dimensional infrared spectroscopy to verify a recent proposal that when water molecules and perchlorate ions (ClO₄⁻) exchange hydrogen bonds, the water molecules rotate in quick jumps rather than in smooth motions. In a separate study, Klaus-Jan Tielrooij and colleagues at the Institute for Atomic & Molecular Physics, in Amsterdam, employed terahertz dielectric relaxation spectroscopy and femtosecond...