Simple separation process for neodymium and dysprosium
9 June 2015

One possible source of these materials is actually at hand: recycling used magnets. So far, however, only a very low percentage of the metals have been obtained from recycling—as mixtures. Because the concentrations of the individual rare-earth metals can vary, they must be separated before reuse. However, this is difficult, energy- and time-intensive, and requires large amounts of solvent.

A team headed by Eric J. Schelter at the University of Pennsylvania has now developed a simple and effective method for separating neodymium and dysprosium from each other. In this process, a special nitroxide ligand is added to simple salts of the metals. This ligand is an organic molecule that grasps an individual metal ion in a coordination complex like a clamp with three "arms". If the bound metal ions have a large radius, like neodymium, pairs of these complexes prefer to form a dimer. In contrast, complexes with small metal ions like dysprosium barely form any dimers at all. As a result, the neodymium complex is fifty times more soluble in benzene than the dysprosium complex.

With a minimal amount of benzene, the researchers were able to leach the neodymium complex out of a 1:1 mixture in about 95 % purity. The solid left behind contained about 95 % of the dysprosium complex. It is possible to increase the purity of both fractions after further purification steps with benzene.

It should be possible to apply this technique to other rare-earth elements. This simple, cost-effective method could make the recycling of rare earths more attractive in the future.
