Aliatges d’argó

Extraordinary pressures and temperatures lead to extraordinary chemistry. Usually, noble gases are among the least reactive elements. Yet tremendously high heat and pressure can bring out chemical traits never seen before. In a simulated environment mimicking the pressure cooker environment of Earth’s core, researchers observe the first stable compound between argon and a metal: ArNi (E. Stavrou et al., ACS Earth Space Chem., 2019, DOI: 10.1021/acsearthspacechem.9b00212). The group put a small amount of powdered nickel in between two micrometer-scale diamonds in a diamond anvil cell, added argon gas, and squeezed the diamonds together. Once the pressure reached 140 GPa, 1,300 times the pressure at the ocean’s lowest depth, the researchers turned on an infrared laser to heat the mixture. Close to 1,500 K, the pressure reached 140 GPa, 1,300 times the pressure at the ocean’s lowest depth, the small amount of powdered nickel in between two micrometer-scale diamonds in a Space Chem.,

first stable compound between argon and a metal: ArNi (E. Stavrou et al., Nat. Catal., 2019, DOI: 10.1038/s41929-019-0368-6). The researchers stumbled across this chemistry when trying to pressurize their reactor with an inert gas. They added gaseous N₂ to a solid-state titanium oxide-supported Ru catalyst, with hydrogen gas and p-cresol, and found that the Ru surface activates the N₂ to form either N₂H or N₂H₃. These acidic hydrogens help boost the –OH groups off the p-cresol, shifting the rate determining step from –OH hydrogenation to N₂ hydrogenation. The group found that the reaction worked well over multiple supports, including Al₂O₃, ZrO₂, and active carbon.

El N₂: inert i catalitzador alhora

Gaseous nitrogen is a bit of a chemical wallflower. While high temperatures and pressures such as those used in the Haber-Bosch process can convince the compound to react, gaseous N₂ rarely acts as an active catalytic species. Now a group of international researchers has found that adding N₂ gas to a ruthenium-based catalyst speeds up the hydrodeoxygenation of p-cresol into toluene by over 400%; it’s a reaction that could have applications in converting bio-oils into useful chemicals (J. Li et al., Nat. Catal., 2019, DOI: 10.1038/s41929-019-0368-6). The researchers stumbled across this chemistry when trying to pressurize their reactor with an inert gas. They added gaseous N₂ to a solid-state titanium oxide-supported Ru catalyst, with hydrogen gas and p-cresol, and found that the Ru surface activates the N₂ to form either N₂H or N₂H₃. These acidic hydrogens help boost the –OH groups off the p-cresol, shifting the rate determining step from –OH hydrogenation to N₂ hydrogenation. The group found that the reaction worked well over multiple supports, including Al₂O₃, ZrO₂, and active carbon.