Abstract

Realizing magnetic remanence in a single atom is the key to store and process information in the smallest unit of matter. To achieve this goal, one needs to protect the magnetic states of the single atom from quantum tunneling of the magnetization and from scattering with the electrons of the supporting substrate. Here we show that individual rare-earth atoms on ultra-thin insulating layers grown on non-magnetic metal substrates exhibit magnetic remanence and, therefore, are the first magnets formed by a single surface-adsorbed atom. In addition, these magnets have a record-high coercive field of 3.7 T, a magnetic lifetime of 1500 s at 10 K, and their hysteresis loop remains open up to 30 K. This first example of a single atom magnet shows bistability at a temperature which is significantly higher than the best single molecule magnets reported so far. Its extraordinary performances are achieved by a suitable combination of magnetic ground state and adsorption site symmetry, as well as by suppressing spin-electron scattering with conduction electrons by ultra-thin insulating layers.