Out-of-Plane Alignment of Er(trensal) Easy Magnetization Axes Using Graphene

We have studied Er(trensal) single-ion magnets adsorbed on graphene/Ru(0001), on graphene/Ir(111), and on bare Ru(0001) by scanning tunneling microscopy and X-ray absorption spectroscopy. On graphene, the molecules self-assemble into dense and well-ordered islands with their magnetic easy axes perpendicular to the surface. In contrast, on bare Ru(0001), the molecules are disordered, exhibiting only weak directional preference of the easy magnetization axis.

The perfect out-of-plane alignment of the easy axes on graphene results from the molecule-molecule interaction, which dominates over the weak adsorption on the graphene surface. Our results demonstrate that the net magnetic properties of a molecular submonolayer can be tuned using a graphene spacer layer, which is attractive for hybrid molecule-inorganic spintronic devices.