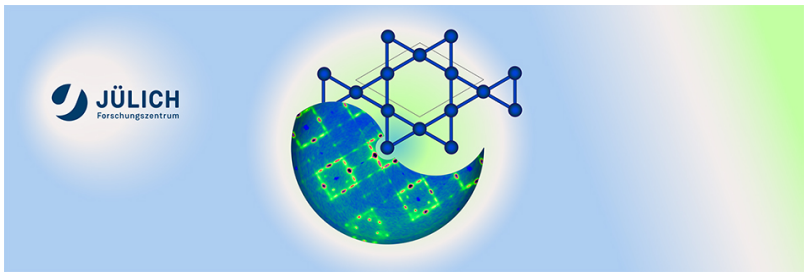

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Nanoscale curvature enhances magnetization in CoPd alloy films on nanospheres

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We have investigated the influence of curvature on the magnetic properties of a Co-Pd alloy by depositing Co-Pd alloy films, with different thicknesses, on monolayers of silicon dioxide (SiO_2) nanospheres, and on flat silicon substrates. The curved films exhibit enhanced magnetic scattering length density (mSLD), particularly for the thinner films, compared to the flat substrates. This is attributed to curvature induced strain and orbital hybridization, which boosts the local magnetic moment. However, as film thickness increases, the structural order of the nanosphere monolayers is disrupted, leading to rougher morphology and eventual coalescence into continuous films. SQUID magnetometry reveals that curvature alters magnetic anisotropy by weakening or tilting perpendicular magnetic anisotropy (PMA) and increasing coercivity. Polarized neutron reflectometry (PNR) confirms stronger in-plane magnetization in curved films, and shows that thinner films exhibit a higher magnetic scattering length density (mSLD) than thicker ones, due to enhanced interface effects in the ultrathin regime. Despite high structural ordering, grazing-incidence small-angle neutron scattering (GISANS) detects no lateral magnetic coherence or domain-related scattering. This study highlights the significant role of curvature in tuning the magnetic properties of CoPd alloy films and underscores the combined power of PNR and GISANS in probing magnetism in such systems.

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