## *7. Magnetic Nanostructures for Energy-Efficient Cooling*

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The primary objective is the realization of the highest efficiency magnetic refrigeration technology based on the design and fabrication of novel nanostructured metamaterials. Magnetic refrigeration uses field-induced manipulations in the spin order of magnetic materials. Controlling the magnetic entropy contribution in a cyclic process gives rise to a periodic temperature decrease of the magnetic material which can be used for cooling appliances analogous to a gas-compression process in conventional refrigeration technology. However, in contrast to the latter, magnetic refrigeration enables cooling efficiencies which are by far greater than conventional gas-compression refrigeration. This technology combines the significant influence on energy conservation with an environmentally friendly operation mode where ozone-depleting chemicals are absent.

The work focuses on tailoring new materials which allow transferring this performance to room temperature and into a moderate magnetic field regime achievable by strayfields of industrial permanent magnets. To realize this performance novel, metamaterials based on nanoparticle systems and artificial heterostructures are designed and grown by modern molecular beam epitaxy and cluster deposition techniques. Advantage is taken of the investigators expertise in nanothermodynamics, magnetic nanostructures and novel nanotechnologies. Nanostructured materials are superior to bulk materials when tailoring fundamental properties such as the magnetic moment per particle, intra- and interparticle as well as intra- and interlayer exchange in nanoparticle and multilayer systems.