Publikationen 2002

G. Radu, U. Memmert, and U. Hartmann
DIRECT OBSERVATION OF THE THERMAL DECOMPOSITION OF LIGAND-STABILIZED CLUSTER

Ligand-stabilized Au_{55} clusters have been observed by scanning probe microscopy upon thermal decomposition on top of graphite and mica substrates. On highly oriented pyrolitic graphite as well as on mica the ligand shell exhibits a thermal decomposition at a temperature of about 390 K. This temperature well matches data obtained on cluster solutions and pallets. The ligand decomposition results under ultrahigh vacuum conditions in the formation of naked Au clusters. The in situ needle sensor studies show that, due to the high cluster mobility at elevated temperatures, bigger spherical Au aggregates are formed on the graphite substrate. In contrast, on the mica substrate, the naked Au clusters aggregate to form small uniform islands that are stable up to temperatures of more than 700 K. Bigger Au aggregates could only be formed upon pushing the clusters by the microscope's probe at elevated temperatures. The significant difference in the cluster decomposition and aggregation processes on graphite and mica is attributed to the influence of a strong cluster-substrate interaction, which is solely present for mica.

*J. Chem. Phys. B **106**, 10301 (2002)*

G. Radu, U. Memmert, and U. Hartmann
HIGH-TEMPERATURE NEEDLE SENSOR INVESTIGATIONS ON THIN AU55 LAYERS

The rearrangement of layers of ligand-stabilized Au_{55} clusters, deposited on graphite and mica substrates, was imaged during heating in ultrahigh vacuum. No thermally induced rearrangement of the clusters was observed below a certain decomposition temperature. Significant modifications of the layer structure were found on both substrates beyond that temperature. The observed critical temperature agrees fairly well with the decomposition temperature obtained from calorimetry measurements on solutions and pallets. At higher temperatures the cluster decomposition and aggregation processes differ significantly for the two substrates. This is attributed to a much stronger cluster–substrate interaction for mica in comparison to graphite.

*Proc. NC-AFM 2001 Conf., Kyoto, Japan, 2001; Appl. Surf. Sci. **188**, 435 (2002)*

M.R. Koblischka and U. Hartmann
SCANNING-PROBE-BASED HIGH-RESOLUTION MAGNETIC IMAGING
*Proc. 3rd EU-NSF workshop on Nanotechnology, Lecce, Italy, 2002; in : **Nanotechnologies – Revolutionary Opportunities And Social Implications**, M. Roco and R. Tomellini (Eds.), Office for Offcial Publications of the European Communities, Luxembourg, 2002*

J. Hu, Y. Zhang, H. Gao, M. Li, and U. Hartmann
ARTIFICIAL DNA PATTERNS BY MECHANICAL NANOMANIPULATION

A special method, which is a combination of macroscopic "modified molecular combing" and microscopic "molecular cutting", is proposed in this paper. DNA strands are first aligned on a solid substrate to form a matrix of 2D networks. Atomic force microscopy is then used to cut the DNA network in order to fabricate fairly complex artificial patterns. Curved and wavy structures are constituted by a manipulation process based on the elastic behavior of DNA strands. A new phenomenon of physical "folding" of DNA induced by the AFM probe has been found. DNA strands can be converted into spherical nanoparticles and nanorods by the special process of "pushing" during which DNA molecules fold up into ordered structures in air.

Nano Lett. ***2****, 55 (2002)*

Y. Xu, U. Memmert, and U. Hartmann
THERMOMAGNETIC PROPERTIES OF FERROMAGNETIC PEROVSKITE MANGANITES

Detailed measurements of the magnetization as a function of temperature and magnetic field for $La_{0.67}Ca_{0.33}MnO_3$, $La_{0.67}Sr_{0.33}MnO_3$, and $La_{0.67}Ba_{0.33}MnO_3$ bulk samples were carried out. Significant entropy changes near the Curie temperature are obtained from the magnetization data. The magnetocaloric effects and potential applications in magnetic cooling of these materials are discussed.

J. Magn. Magn. Mater. ***242****, 698 (2002)*

M. Oberringer and U. Hartmann
NANOBIOTECHNOLOGISCHE ANSÄTZE IN DER ZYTOGENETIK
Bioforum ***4****, 206 (2002)*

M. Oberringer, W. Metzger, and U. Hartmann
BEISPIELE NANOBIOTECHNOLOGISCHER ANSÄTZE IN GRUNDLAGEN-FORSCHUNG UND INDUSTRIELLER ANWENDUNG
Magazin Forschung ***2****, (2002)*

S. Mathur, M. Veith, H. Shen, V. Sivakov, V. Huch, U. Hartmann, and H. Gao
PHASE SELECTIVE DEPOSITION AND MICROSTRUCTURE CONTROL IN IRON OXIDE FILMS OBTAINED BY SINGLE-SOURCE CVD

Iron(III) tert-butoxide, [Fe(OtBu)3]2, was used as a single source for iron and oxygen to obtain nanocrystalline hematite (Fe2O3) or magnetite (Fe3O4) films by low-pressure (LP) CVD. The decomposition profile of the molecular precursor and the crystallization temperature of iron oxide were derived from thermogravimetry/differential thermal analysis (TG/DTA). The substrate temperature was found to markedly influence the morphology and Fe/O stoichiometry in the deposited films. The morphological features and phase identification of the grown films were obtained by scanning electron microscopy (SEM) and X-ray diffraction (XRD), respectively. The compositional identity of the phases was determined by the X-ray photoelectron spectroscopy (XPS) of the CVD deposits. Annealing the films ex-situ under reducing or oxidizing conditions allows selective interconversion (Fe2O3 Fe3O4) among the deposited phases with no particle size variation. The interplay between the rate of precursor delivery and substrate temperature controlled the mean particle size in the films. Magnetite film with a mean particle size of 10 nm was obtained on silicon at 450 °C. Formation of larger grains and grain clusters was observed at higher temperatures. High coercivity (4000 Oe) and small saturation magnetization (0.3 emu g-1) of the Fe3O4 film confirmed superparamagnetic behavior due to small particle size. Absorption spectra of magnetite and hematite films deposited on glass show them to be transparent to the visible light. The sheet resistance of nanocrystalline Fe3O4 and Fe2O3 films was found to be 2.4 k and 2 M, respectively.

Chem. Vap. Deposition ***8****, 277 (2002)*

Y. Xu , P. Das, M. R. Koblischka, U. Hartmann, and M. Meier
PEROVSKITE MANGANITES: POTENTIAL MATERIALS FOR MAGNETIC COOLING AT OR NEAR ROOM TEMPERATURE

Perovskite manganites are known as functional materials showing colossal magnetoresistance and are used as magnetic sensors. We report on the synthesis and characterization of La0.67Ca0.33MnO3, La0.67Sr0.33MnO3, and La0.67Ba0.33MnO3 polycrystalline bulk materials. Detailed measurements of the magnetization as function of temperature and magnetic field for these samples were carried out. Significant entropy changes near the Curie temperatures are obtained from the magnetization data. The specific heat changes of these samples near their phase transition temperatures are derived from magnetic measurements. Our results and the relevant data from various references are summarized. Furthermore the magnetocaloric effects and potential applications in magnetic cooling of perovskite manganite materials are evaluated.

Proc. E-MRS Spring Meeting 2002, Strasbourg, France; Cryst. Engin. ***5****, 383 - 389 (2002)*