and transforms to an anti-ferromagnetically ordered state ($\theta_b = -18.6(2) \text{ K}$) below 33 K. The magnetic spin structure can be described with $k = \{0, 0, 0\}$ in space group $Pmca$ and it is similar to the one of the $C2/c$ phase except that it is non-collinear in nature, i.e. there are components of the magnetic moment along all three crystallographic axes. Small magnetoelastic coupling is observed in the orthorhombic phase. More details are reported in [5].


**Keywords:** pyroxene, neutron diffraction, magnetism

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**FA5-MS41-P04**

**Magnetostuctural and magnetocalorific properties of Ni$_{50-x}$Cu$_x$Mn$_{36}$Sn$_{14}$ by magnetic measurements and neutron diffraction experiments. Ilker Dincer $^1$, Yalcin Elerman$^2$, Erçüment Yüzüak$^2$, Markus Höltzel$^3$, Anatoly Senyshyn$^4$, Eyüp Duman$^2$, Thorsten Krenke$^2$, 1Department of Engineering Physics, Faculty of Physics, Ankara University, Ankara, Turkey, 2Institute for Materials Science and Geosciences, University of Technology Darmstadt, Germany, 3Thysen Krupp Electrical Steel GmbH, D-45881 Gelsenkirchen, Germany E-mail: idincer@eng.ankara.edu.tr

Compared with conventional refrigeration, magnetic refrigeration technology has many advantages, such as the absence of harmful gas, less noise, low cost and high efficiency. Since the discovery of martensitic transformation with both phases magnetically ordered in Heusler alloys Ni$_{50-x}$Mn$_x$Sn$_{14}$ by magnetic measurements and neutron diffraction experiments, Ilker Dincer$^1$, Yalcin Elerman$^2$, Erçüment Yüzüak$^2$, Markus Höltzel$^3$, Anatoly Senyshyn$^4$, Eyüp Duman$^2$, Thorsten Krenke$^2$. (2010) http://dx.doi.org/10.1007/s00269-009-0335-x.

**Keywords:** pyroxene, neutron diffraction, magnetism
0.02 and 0.06 alloys are found -16.5 J.kg⁻¹K⁻¹ and -14.2 J.kg⁻¹K⁻¹ from the DSC analysis around the structural transition temperatures, respectively. Since the values of the relative cooling power and the isothermal magnetic entropy change of the x=0.02 alloy is bigger than of the Gd₅Ge₂₀.₀₅S₁₉₅ alloy, this alloy should be good candidate for room temperature magnetic cooling technology [2].


Keywords: Structural phase transition, Magnetic materials, Magnetic entropy change

FA5-MS41-P06

Opechowski-Guccione-like symbols of magnetic space groups. Hans Grimmer, Laboratory for Developments and Methods, Research with Neutrons and Muons, Paul Scherrer Institut, Villigen, Switzerland E-mail: Hans.Grimmer@psi.ch

For the magnetic space group types with black and white lattice two sets of symbols have been proposed: the BNS symbols [1] and the OG symbols [2]. Whereas generators of the group can be read off the BNS symbol, the International Tables for X-Ray Crystallography (1952) must be consulted to interpret the OG symbols in the cases where the black and white lattice is centred. We shall define OG-like symbols in the case of centred lattices in such a way that generators of the group can be deduced directly from the symbol [3]. The definition generalizes a proposal of Bertaut [4] for crystal class mmm to every crystal class.


Keywords: magnetic space groups, Opechowski-Guccione symbols, Belov-Neronova-Smirnova symbols

FA5-MS41-P07

Temperature dependent Neutron Diffraction Studies on Iron PNictide Single Crystals Martin Mevena, Yixi Su, Y. Xiao, FRM II, Technische Universität München, Germany, JCNS, IFF, Forschungszentrum Jülich, Outstation at FRM II, Garching, Germany, IFF, Forschungszentrum Juelich, Germany E-mail: martin.meven@frm2.tum.de

The single crystal diffractometer (SCD) HEIDi at the hot source of the research neutron source Heinz Maier-Leibnitz (FRM II) was developed as a co-operation of the RWTH Aachen and the TU München [1]. The short neutron wavelengths (0.4 Å < λ < 1.2 Å) of the instrument allow detailed studies of nuclear structures and the magnetic order of compounds with similar or highly absorbing elements. Thus, HEIDi is an ideal tool for studies on the recently discovered superconducting iron pnictides. In spite of the different chemical composition there are significant similarities between the iron pnictides and the high-Tc cuprates discovered in 1986. In both cases the layered structures undergo a crystallographic phase transition from a tetragonal room/high temperature phase to an orthorhombic low temperature phase. In addition, doping with suitable elements influences the appearance and disappearance of magnetic and superconducting phases significantly.

Detailed studies of undoped single crystals of BaFe₄As₂ and EuFe₄As₂ were performed on the SCD HEIDi to improve the understanding of the superconducting A-122 compounds. Due to the combination of plate-like sample shapes, the complexity of the orthorhombic phase (reflection splitting due to appearance of domains and twinning) and the high absorption of the Eu sample made the precise data collections as well as the accurate interpretation of the results quite challenging but gave a deep insight to the phase transitions and magnetic order at low temperatures [2, 3] of these compounds.


Keywords: Instrumentation, Magnetism, Phase transition

FA5-MS41-P10

Structural Aspect of Stabilization of Magnetic Particles in Solution: SANS Study Eleonora Shytvyka, Petr Konarev, Lyudmila Bronstein, Dmitriy Svergun, Institute of Crystallography, Russian Academy of Sciences, Moscow, Russia, EMBL Hamburg Outstation, Germany, Indiana University, Department of Chemistry, USA E-mail: viwopixx@yahoo.co.uk

A problem of stabilization of iron oxide magnetic nanoparticles (NPs) in solution is of special importance due to their possible application in life science, medicine, and particularly in anti-cancer therapy. Precondition for such applications is water solubility, which can be achieved by introducing a biocompatible shell on the hydrophobic NP surface. These coatings must fulfill certain requirements, and, first of all, they must prevent the aggregation of nanoparticles in solution. Functional properties of the protective shells depend strongly on their thickness, density, chemical composition and structure. Moreover, the practical use of the ferromagnetic liquids is determined by the metal particle shapes, size and size distributions. Therefore, all these characteristics of the specimens should be comprehensively characterized. In this work we report structure and properties of iron oxide NPs synthesized by decomposition of iron oleates and encapsulated by different methods. We analyze also the process of micellization of differently grafted PMACOD in water solution, and the ability of the various coatings to encapsulate the NPs. The detailed structural investigation of the specimens was performed using small angle X-ray scattering (SAXS) and a complex of modern tools of SAXS data interpretation and modeling.

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