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Keywords: phase transitions, superstructure, TiOCl TiOBr VOCl

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Studies of the Magnetic Ordering in Polycrystalline Cr-Ru Alloys by Neutron Powder Diffraction
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The magnetic phase diagram of the Cr-Ru alloy system [1,2] shows that the spin density wave (SDW) ordering below the Néel temperature is incommensurate (I) for Ru concentrations (x) < 1%, commensurate (C) for 1% < x < 17%, with the formation of a superconducting state for x > 17% [2].

Our approach to identify the nature of the magnetic ordering has always encompassed neutron diffraction studies on single crystal samples in which the different SDW orderings give rise to specific intensity distributions around the {100} reciprocal lattice position [3].

We here report experimental results from neutron powder diffraction studies of polycrystalline samples with x = 0.3%, 12.5% and 15% representative of the I and C phases. This has become an option with the availability of the upgraded neutron powder diffraction instrument at the SAFARI-1 research reactor.

The results demonstrate the viability of using diffraction pattern distributions from polycrystalline samples to research intricacies in the magnetic ordering of dilute alloys of Cr in future studies.

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Keywords: neutron powder diffraction, spin-density wave, magnetic phases

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Magnetic Transitions in $ErCo_{10}Mo_{2-x}M_x$ (M=Si and V)
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The intermetallic compounds of the type $R(T,M)_{12}$ (R=rare earths, T= Fe, Co, Ni and M=stabilizing elements like Mo, Si, V etc) that find many applications as permanent magnet materials exhibit tunable magnetic characteristics. Tuning of the magnetic anisotropy values, Curie and spin reorientation temperatures are made possible by replacing the constituting elements with others in specific proportions. X-ray powder diffraction and low field magnetization studies on $ErCo_{10}\ Mo_{2-x}M_x$ (M=Si, V) in the temperature range between 5K - 800K have revealed that:

i) all members of the family crystallize in $ThMn_{12}$ type structure with tetragonal I4/mmm space group.

ii) Si for Mo replacement leads to a linear decrease of lattice parameters, a significant shift of Tc from 425K to 719K and a Tsr reduction from 139K to 74K.[1]

iii) V for Mo replacement leads to a linear decrease of lattice parameters, no significant change in Tc and a strong shift of primary Tsr from 139 to 350K.[2]

These findings together with structural and magnetic transition implications will be presented.

[1]Zhao Z.G., de Groot C.H., Brück E., Buschow K.H.J., de Boer F.R., *Physica B*, 1996, **228**, 214. [2] Brabers J.H.V.J., Zhou G.F., de Boer F.R., Buschow K.H.J., *J. Mag. Mag. Mat.*, 1993, **118**, 339-346.
Keywords: spin reorientation, Curie temperature, magnetic anisotropy

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X-ray Diffraction and Absorption Study under Strong Pulsed Magnetic Fields
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Diffraction experiments under non-ambient conditions have been developed for decades. Nowadays x-ray experiments over 100 GPa can be carried out using a diamond anvil cell. For ultra-low-temperature experiments, neutron and x-ray experiments below a few hundred mK are performed at several places. In contrast, diffraction experiments under strong magnetic field are limited below about 20T.

Recently, we have developed very small pulsed magnets [1]. Typical dimensions of the coils are 20 mm in diameter and 25 mm in length. Hence, the coil is readily attached to the cold head of a conventional closed cycle refrigerator, and is easily installed in a conventional x-ray diffractometer. Although the coils are small, magnetic fields above 30 T can be generated. Using this miniature coil and intense synchrotron x-rays, we conducted x-ray diffraction experiments under strong pulsed magnetic fields at beamline BL22XU at SPring-8. The field induced structural phase transition around 9 T in $Pr_{0.6}Ca_{0.4}MnO_3$ and the valence transition around 26 T in $YbInCu_4$ were clearly observed. Our new plan for x-ray absorption experiments under pulsed magnetic fields is also presented.

[1] Matsuda Y.H., et al., *Physica B*, 2004, **346-347**, 519.
Keywords: pulsed magnetic field, magnetic structural phase transition, valence fluctuations

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Magnetic field induced polymorphism of R_5T_4 compounds
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Structural rearrangements triggered by a magnetic field are rare compared to temperature and/or pressure induced polymorphism. While the latter is routinely probed *in situ* by temperature and pressure dependent powder diffraction, the most common tools employed in detecting magnetic field induced polymorphism remain bulk field-dependent measurements of the physical properties, e.g., the electrical resistance, magnetization and strain. On one hand, discontinuities in these macroscopic properties serve as suitable evidence of a structural phase transition, but on the other hand, they provide no clues about its atomic-scale mechanism. By successfully coupling a rotating anode powder diffractometer with a continuous-flow cryostat and a split-coil superconducting magnet we were able to obtain excellent-quality Rietveld-ready powder diffraction data between 2.5 K and 315 K in 0 to 4 T magnetic fields. This allowed us to study the magnetic field-induced polymorphism in several polycrystalline compounds from the R_5T_4 family, where R = lanthanide metal, T = Si, Ge and/or Sn.

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Keywords: phase transitions, powder diffractometry, structural physical properties

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When 2+2 isn't 4
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Recently much work has gone into examining the photoexcited HS state of iron(II) spin crossover compounds in full structural detail[1]. So far this work has focused on compounds closely related to the early work with either two neutral tridentate ligands or two