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Referee's report on the doctoral thesis manuscript of Petr Čermák entitled : « Magnetic properties of R_2TIn_8 and related tetragonal compounds » and presented to the Charles University in Prague.

The presented manuscript of the PhD Thesis of Petr Čermák deals with the results of structural and magnetic properties of R_2TIn_8 type compounds. These phases have tetragonal symmetry and are part of a wider family deriving from the $CeIn_3$ structure corresponding to the following formulae $R_nT_mX_{3n+2m}$, where R is rare earth, T is a transition metal element and n and m are integers. These phases have attracted much attention nowadays in the scientific community in particular the Ce containing ones which present remarkable heavy-fermions with interesting magnetic as well as superconductivity properties. The thesis manuscript has altogether 103 pages including appendix, 48 figures and 105 well arranged references.

Petr Čermák has first successfully grown single crystal materials of the R_2RhIn_8 series of compounds by solution growth method with R = Nd, Tb, Dy, Ho, Er, Tm, La, Lu, Y. The crystal structure study has been performed by neutron diffraction on single crystal enabling to investigate the magnetic structure. These measurements have been carried out by Laue as well as 4 circles diffractometry techniques at Helmholtz-Zentrum Berlin or at the Institut Laue Langevin Grenoble.

The first chapter is devoted to a short but clear presentation of the theoretical background and formalism of the magnetism of rare-earth and magnetic structures. The basics of strongly correlated systems and heavy fermions are also presented even if the thesis is focussed on non-cerium analogues of the Ce_2RhIn_8 containing normal magnetic rare-earth elements.

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The second chapter is giving a description of the numerous experimental methods used by Petr Čermák during his PhD starting from the sample synthesis followed by the techniques used for characterizing the bulk magnetic properties. An emphasis is naturally given to the description of the various neutron scattering techniques used in this work since these techniques are at the heart of this research work. All the aspects are presented starting from the instrument geometry, the detectors and the data treatment. It is worth to mention here that treating Laue data is not trivial but is a crucial point to get the best out of the newly developed neutron Laue instruments. Petr Čermák has contributed here to the development of new software for efficient Laue pattern treatment.

The state of the art of the knowledge of the R_2TX_8 and RTX_5 and related phases is presented in the frame of chapter three. After a description of the structural relationships between the different $R_nT_mX_{3n+2m}$ series of compounds, an overview of the Ce compounds is given followed by a summary of the bulk properties and magnetic structures of the non cerium analogues. This chapter is well documented and gives useful references.

Chapter four contains the description of the sample preparation of single crystals and their structural characterization by X-ray diffraction. But the main part of the manuscript is the description and the discussion of the experimental results obtained on the magnetic properties of the R_2RhIn_8 compounds. I have one remark, related to Table 7 (page 41) an estimation of the error bars would be an added value to help the reader to evaluate the accuracy of the parameters extracted from the specific heat measurements. The data are well analysed and the number of different experimental methods used by the applicant is high: specific heat, laboratory magnetometry, neutron scattering techniques (Laue, 4-circles diffraction, inelastic scattering), high pulsed magnetic field... Combining these results, the applicant has nicely determined the magnetic ground state of the R_2RhIn_8 studied compounds but also their magnetic phase diagram versus temperature and field. The magnetic phase diagram of Ho_2RhIn_8 is remarkably rich with three different region exhibiting different magnetic antiferromagnetic structures. Petr Čermák showed his ability to perform complex study of the selected samples. I have a suggestion concerning the rare earth magnetic moment obtained for the Dy_2RhIn_8 and Er_2RhIn_8 compounds. The values given in Table 15 (section 4.4.3) are significantly reduced comparison to the expected trivalent rare-earth moments, this point could have been discussed. However remarks and suggestion mentioned in this report do not decline the excellent quality of the thesis work presented here.

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As an evaluation, I can state that the applicant succeeded to prepare new R_2RhIn_8 single crystals, characterized them by different methods using contemporary experimental methods and up to date data treatments. The manuscript presented by Petr Čermák is a useful and important contribution to the study of these series of intermetallic compounds. Investigations of the physical properties as well as the magnetic structure studies have been done carefully and the results convincingly discussed in the text. In addition, during his stay at the Institut Laue Langevin, Petr Čermák has also contributed to the development of neutron spectrometer and neutron diffraction analysis software.

At this stage of his career, Petr Čermák has already published about ten articles in international peer-review journals four of which are dealing with R_2TIn_8 type compounds whereas others are focussed on neutron instrumentation. Petr Čermák is the first author of most of these. Articles have mostly several coauthors from different institute showing the ability of the applicant to participate in effective collaborations.

For all these reasons I can state that the candidate definitely presented the ability to conduct the research in independent way and the dissertation can be accepted.

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