

Accepted Manuscript

Molecular realizations of 3D Heisenberg magnet: Critical scaling

Robert Pełka, Dawid Pinkowicz, Barbara Sieklucka, Magdalena Fitta

PII: S0925-8388(18)32292-8

DOI: [10.1016/j.jallcom.2018.06.171](https://doi.org/10.1016/j.jallcom.2018.06.171)

Reference: JALCOM 46507

To appear in: *Journal of Alloys and Compounds*

Received Date: 9 May 2018

Revised Date: 15 June 2018

Accepted Date: 16 June 2018



Please cite this article as: R. Pełka, D. Pinkowicz, B. Sieklucka, M. Fitta, Molecular realizations of 3D Heisenberg magnet: Critical scaling, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.06.171.

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Molecular realizations of 3D Heisenberg magnet: critical scaling

Robert Pełka¹, Dawid Pinkowicz², Barbara Sieklucka², Magdalena Fitta^{1*}

¹Institute of Nuclear Physics Polish Academy of Sciences, 31-342 Kraków, Poland

²Faculty of Chemistry, Jagiellonian University, 30-387 Kraków, Poland

* E-mail: Magdalena.Fitta@ifj.edu.pl

Abstract

The critical properties of two related bimetallic compounds $\{[M^{II}(\text{H}_2\text{O})_2]_2[\text{Nb}^{IV}(\text{CN})_8] \cdot 4\text{H}_2\text{O}\}_n$ ($M = \text{Mn}, \text{Fe}$) are reported. The compounds exhibit the transition to a magnetically ordered phase at $T_c = 43$ K in the case of the Fe-based sample (**FeNb**), and at $T_c = 50$ K for the Mn-based sample (**MnNb**). They differ in relative orientation of the M and Nb sublattices, which is parallel, i.e. ferromagnetic, in **FeNb** and antiparallel, i.e. ferrimagnetic, in **MnNb**. Critical exponents β and γ , governing the temperature dependence of the spontaneous magnetization below T_c and the temperature dependence of the initial susceptibility above T_c , respectively, have been determined using the Kouvel-Fisher method. Critical exponent δ has been obtained through the analysis of the critical magnetization isotherm. Thus determined values of the critical exponents were verified by employing two independent forms of the scaling equation of state. All the magnetization data are demonstrated to collapse either onto two universal branches corresponding to $T < T_c$ and $T > T_c$, respectively, or onto a single universal curve. The critical exponents allow to ascribe **FeNb** as well as **MnNb** to the universality class of the three-dimensional (3D) Heisenberg model.

Keywords

molecular magnets, critical behavior, phase transition

Highlights

- Critical behavior in $\{[M^{II}(\text{H}_2\text{O})_2]_2[\text{Nb}^{IV}(\text{CN})_8] \cdot 4\text{H}_2\text{O}\}_n$ ($M = \text{Mn}, \text{Fe}$) is studied
- The critical exponents β and γ have been determined using the Kouvel-Fisher method
- The critical exponent δ has been obtained based on critical magnetization isotherm
- The values of β and γ were verified by two forms of the scaling equation of state
- Both compounds can be assigned to the universality class of the 3D Heisenberg model

Download English Version:

<https://daneshyari.com/en/article/7990547>

Download Persian Version:

<https://daneshyari.com/article/7990547>

[Daneshyari.com](https://daneshyari.com)