This article was downloaded by: [Tomsk State University of Control Systems and Radio]

On: 20 February 2013, At: 12:05

Publisher: Taylor & Francis

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH,

UK



Molecular Crystals and Liquid Crystals

Publication details, including instructions for authors and subscription information: http://www.tandfonline.com/loi/gmcl16

Heat Capacity Measurements on TaS₃

Katica Biljaković ^a , Ana Smontara ^a & Mladen Prester ^a

Institute of Physics of the University, P. O. Box 304,
 41001, Zagreb, Yugoslavia
 Version of record first published: 20 Apr 2011.

To cite this article: Katica Biljaković, Ana Smontara & Mladen Prester (1985): Heat Capacity Measurements on TaS₃, Molecular Crystals and Liquid Crystals, 121:1-4, 75-77

To link to this article: http://dx.doi.org/10.1080/00268948508074834

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: http://www.tandfonline.com/page/terms-and-conditions

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae, and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages

whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

Mol. Cryst. Liq. Cryst. 1985, Vol. 121, pp. 75-77 0026-8941/85/1214-0075/\$10.00/0
© 1985 Gordon and Breach, Science Publishers, Inc. and OPA Ltd. Printed in the United States of America

HEAT CAPACITY MEASUREMENTS ON ${\sf TaS}_3$

KATICA BILJAKOVIĆ, ANA SMONTARA AND MLADEN PRESTER Institute of Physics of the University, P.O.Box 304, 41001 Zagreb, Yugoslavia

Abstract - We have measured the heat capacity of TaS3 in the temperature range 60-180K with a resolution better than 2% in order to investigate hysteresis effects around 100K. We observe hysteresis in heat capacity between 100K and 130K which corresponds to the resistivity hysteresis and to some anomalies in non linear properties associated with the motion of the CDW.

INTRODUCTION

Orthorhombic TaS2 undergoes a Reierls transition at T=215K1. It was originally reported that the charge density wave (CDW) was commensurate with the underlying lattice with a periodicity of four lattice constants along the chain axis². After observation of anomalies in the transport properties of orthorhombic ${\sf TaS}_{\sf q}$ more recent electron diffraction measurements demonstrated that below 215K the wavelength of the Peierls transition is slightly incommensurate with the lattice and is temperature dependent, locking in to four lattice constants at T_{∞} 130K. This commensurate-incommensurate transition is observable in the temperature variation of the resistivity along the chain axis and also in the non linear properties like temperature variation of the electric threshold field and the ratio of the periodic noise frequency to the current carried by the \mathtt{CDW}^3 . Furthermore recent investigation of the response to high field pulses 4 and accurate measurements of the ohmic conductivity 6 have shown the presence of metastable states in this system. In view of the intriguing transport properties of ${\sf TaS}_3$, measurements of thermal properties are also of great interest.

in this paper we present new data for the heat capacity of orthorhombic ${\sf TaS}_3$ and show the presence of thermal hysteresis.

HEAT CAPACITY

Heat capacity measurements were made using an improved heat pulse technique whose basic principles have been described previously. The cooling and heating rates were both about 1K/hour and heating pulses of about 0,1K were applied to the sample.

As shown in Fig.1 there is a hysteresis of about 3-4% in the temperature region between 100K and 130K. The results represented the heat capacity of the whole sample (TaS₃, silicone grease, Cu container etc). The extra specific heat arising from the sample holder etc. has not yet been measured, we expect that the contribution of a parasitic specific heat will be about the half of the total heat capacity, i.e. the hysteresis in the specific heat of TaS₃ will be 6-8%.

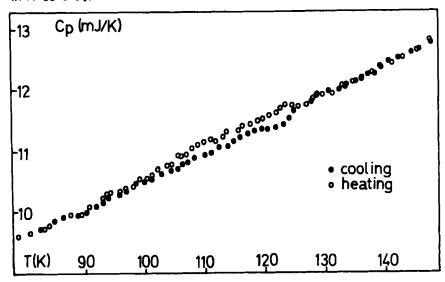


Fig. 1 Total heat capacity of TaS₃ (sample + parasitic heat capacity) versus temperature

The hysteresis in heat capacity occurs in the range 100-130K and is probably the same origin as that in the resistivity. The heat capacity is directly related to the order parameter or the amplitude of the CDW. Thus the results reported here give further support for the suggestion that there is hysteresis in the amplitude of the CDW, associated with the presence of the metastable states.

ACKNOWLEDGEMENTS

We are very grateful to F.Lévy for sending us the samples and to P.Monceau for supporting this measurements. We have also had helpful discussions with our collegues in Zagreb especially with A.Bjeliš and J.Cooper.

REFERENCES

- T.Sambongi, K.Tsutsumi, Y.Shiozaki, M.Yamamoto, K.Yamaya, Y.Abe, Solid State Commun. 22 729 (1977)
- K.Tsutsumi, T.Sambongi, S.Kagoshima, T.Ishiguro, J.Phys.Soc.Japan 44 1735 (1978).
- Z.Z.Wang, H.Salva, P.Monceau, M.Renard, C.Roucan, R.Ayroles, F.Lévy, L.Guemas and A.Meerschent, J.Physique 44, L311 (1983)
- 4. G.Mihály and L.Mihály, Solid State Commun. 48, 449 (1983)
- Gy. Hutiray, G. Mihály and L. Mihály, Solid State Commun. 47, 121(1983)
- 6. A.W. Higgs and J.G. Gill, Solid State Commun. 47,737 (1983)
- D. Djurek, K. Franulović, M. Prester, S. Tomić, L. Giral and J. M. Fabre, Phys. Rev. Letters, 38 715 (1977)
- G.Mihály, Gy.Hutiray and L.Mihály, Solid State Commun. 48,203 (1983)