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High Pressure and High Magnetic Field Effects on Spin-Peierls Systems

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Long range magnetic orders do not take place at finite temperature in *ideal* one-dimensional magnetic systems. In the last decades a large number of *quasi*-one-dimensional compounds have been prepared. At sufficiently high temperatures they behave as predicted for really one-dimensional systems. However, at low temperatures, a cross-over takes place to a state of higher dimensionality. We will examine $S = 1/2$ antiferromagnetic Heisenberg chain. They present, at low temperatures an antiferromagnetic Néel state or a spin–Peierls state [1].

High magnetic fields and high pressure experiments, where magnetization, neutron scattering, transport properties have been studied at high magnetic fields or high hydrostatic pressure are reported. Non-magnetic to magnetic transitions are obtained as a function of both applied magnetic field and hydrostatic pressure. These experiments have been performed on two donnor–acceptor compounds, TTF–BDT (Cu) and MEM $(TCNQ)_2$ which present spin–Peierls transitions respectively at 12 K [2, 3] and at 19 K [4, 5]. $MEM(TCNQ)_2$ is of major interest since it possesses also an electronic Peierls transition at $T = 335$ K and atmospheric pressure. Then in $MEM(TCNQ)_2$, the spin–Peierls transition, T_{SP}, which is a magnetic to non-magnetic transition is associated with a $2k_F$ lattice distortion and the electronic Peierls transition T_{EP}, which is a metal to insulator transition, is associated with a $4k_F$ lattice distortion.

In the two compounds, it has been shown that the T_{SP} transition decreases with the applied field. Below T_{SP}, it appears in high field a new magnetic phase, characterized by a susceptibility which does not decrease to zero with the temperature. The critical fields are respectively 110 kOe and 190 kOe for TTF–BDT(Cu) and $MEM(TCNQ)_2$ [6, 7].

In $MEM(TCNQ)_2$ the high pressure phase diagram evidences a rapid decrease of the electronic Peierls transition [8] and an increase of the spin–Peierls transition with the applied pressure [9]. Above 4 kbar, the $2k_F$ and the $4k_F$ distortions disappear. The crystallographic parameters of the triclinic cell have been determined at 4.2 kbar and high pressure (4.6 kbar). These parameters are very close to those measured in the uniform phase above the electronic Peierls transition [9].

References

1. For a review see: Bray, J. W., Interrante, L. V., Jacobs, I. S. and Bonner, J. C., in Extended Linear Chain Materials (Edited by J. S. Miller). Plenum, New York (1982); de Jongh, L. J. and Miedema, A. R., Adv. Phys. **23,** 1 (1974).
2. Bray, J. W. et al., Phys. Rev. Letters **35,** 744 (1975).
3. Jacobs, I. S. et al., Phys. Rev. **B14,** 3036 (1976).
4. Huizinga, S. et al., Phys. Rev. **B19,** 4723 (1979).
5. Huizinga, S., Thesis, Gröningen (1980).
6. Bloch, D. et al., Phys. Rev. Letters **44,** 294 (1980).
7. Bloch, D. et al., Phys. Letters **82A,** 21 (1981).
8. Bloch, D. et al., in Physics of Solids Under Pressure. (Edited by J. S. Schilling and R. N. Shelton). North Holland, Amsterdam (1981).
9. Bloch, D. et al., To be published.