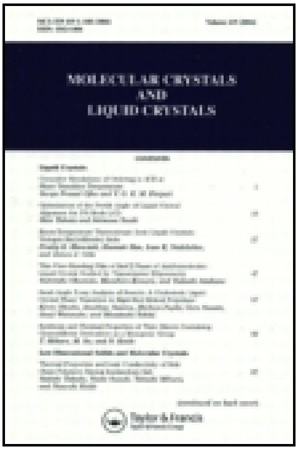

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Tunneling Spectra in $NbSe_3$./I/Pb junctions

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Tunneling Spectra in $NbSe_3$/I/Pb junctions

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$NbSe_3$ goes throught two phases transition inducing SDW states for T_1= 149 K and T_2= 59 K. These two transitions bring a partial condensation at Fermi level, the low temperature conductivity being always of metallic type. The evaluation of the width of the "gap" cannot be done simply. We employed this word "gap" althought it is incorrect here. Tunneling effect has permitted us to obtain an estimation of this "gap" for P=1 bar and P=1 Kbar. We have kept tunneling spectra only for $T < T_2$. For $T_1 > T > T_2$, the width of the "gap" and thermal broadening are such that a measure is too imprecise. We have used the lead superconductivity as a test of good tunneling devices.

The presence on our curves (figure 1, 2 and 3) of phonon-electron interactions shows that we have good tunneling spectra. It is clear that lead tunneling spectra is not modified wwhich indicates that the N(E) variation around Fermi level is slow and covers a wide domain. This is shown by a calculation from the classical expression

$$I(V) = I_o \int_{-\infty}^{+\infty} N(E)_{Pb} \cdot N_2\ (E + eV)\ \{ f(E) - f(E+eV) \}\ dE$$

in which $N_2(E)$ have the shape indicated by the figure 4.

The inserts in figures 2 and 3 show the evolution of R (T) = dV/dI (V=0) versus temperature. It is clear that R (T) increases from T_2 = 58 K at P = 1 Kbar and T'_2 = 54 K at P = 1 Kbar. If we take for the gap value the width between the points where

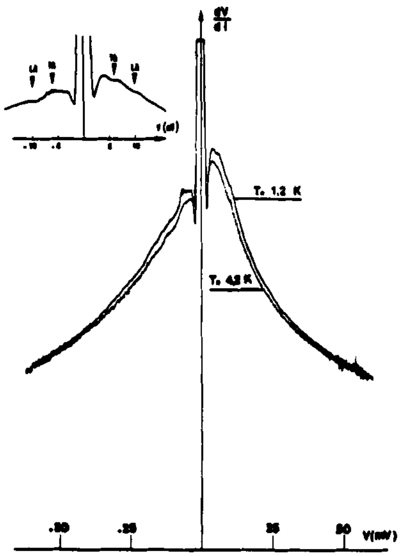

Figure 1 : Classical tunneling spectra at ambiant pression and at low temperature obtained with $NbSe_3$/I/Pb junction. In insert the phonon-electron interactions are clearly seen.

R(T) increases significantly we obtain :

$$\frac{2\,\Delta\,(1\ \text{bar})}{kT_2} \simeq \frac{2\,\Delta\,(1\ \text{Kbar})}{kT'_2} \simeq 14$$

This value is of the same order as those obtained for same type of conductors (1). We can see that for P = 1 Kbar (figure 3) R(T) is higher than for P = 1 bar (figure 2). On the other hand the curves dV/dI (V) cover a wider surface at P = 1 bar than at P = 1 Kbar. That is to say that for a moderate pressure, CDW and superconductivity don't coexist ; $N(E_F)$ and the global

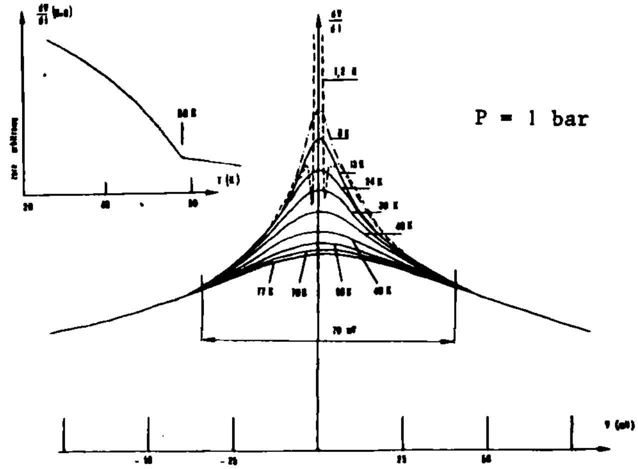

Figure 2 : Evolution with temperature of dV/dI versus bias voltage at ambiant pressure. The insert shows the temperature dependance of dV/dI (V=0).

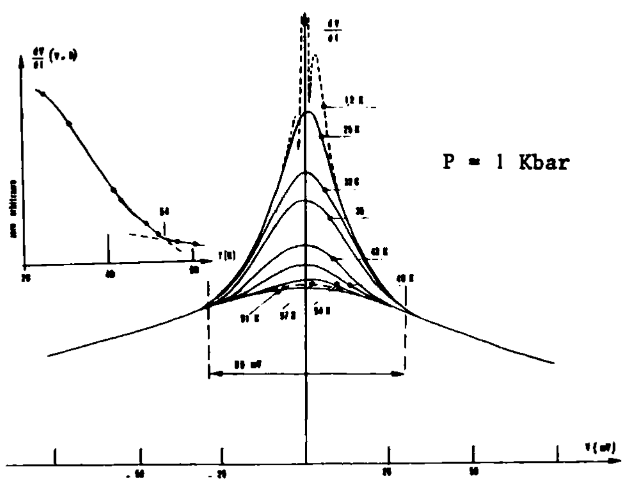

Figure 3 : Evolution with temperature of dV/dI versus bias voltage at P = 1 Kbar. It is interesting to compare the inserts of figure 2 and 3.

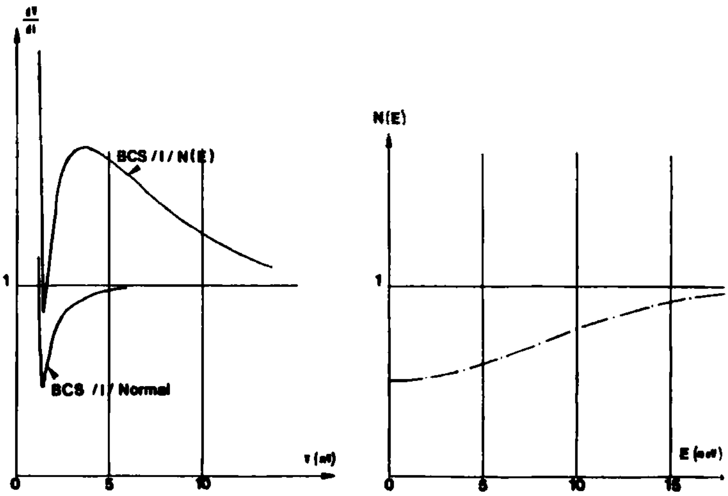

Figure 4 : This figure BCS/I/N(E) shows the theoritical modification induced by the presence of density of states N(E) (right curve) and we have compared this curve to another when N(E) is metallic or normal.

condensation are weaker (i.e. the "gap" becomes deeper and thinner). The observation of tunneling spectra at higher pressure should permit a verification if the hypothesis advanded by FRIEDEL (2) to explain the evolution with temperature of superconductive transition of $NbSe_3$ are correct.

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(1) C. SAINT LAGER Thesis, Grenoble (1983)

(2) J. FRIEDEL J. Physique Lettres 36, 279 (1975)