CONCLUDING REMARKS

1. General Conclusions:

The charge transfer complexes of the precursor of organic ferromagnets such as TEMPO free radical, galvinoxyl, meso-tetraphenylporphine, TADE and tetraphenylbutadine along with some magnetic conductors like CTCS of BEDT – TTF and TMTSF have been studied with FTIR spectroscopy. Apart from this CTCS of decamethylferrocene, decamethylcobaltocene and decamethylcobaltocene cenium cation which are low – temperature ferromagnets have also been studied. Many CTCS studied in the present work are expected to be ferromagnetic at low temperatures. Magnetic nature of CTCS of TEMPO free radical could be explained with a transition to a Pauli paramagnetic phase with orbital overlap due to thermal contraction. The complexes of galvinoxyl could be spin – Peierls systems or Mott – Hubbard boundary cases. These CTCS are small band gap semiconductors around room temperature. The CTCS of TPP (tetraphenylporphine) show band conduction and Gaussian bands due to delocalization of charge carriers. Mn – TPP complexes are ferromagnetics. TADE is magnetic due to bulky substituents TADE$^{+2}$ dication is formed in its CTCS. The luminescent material TPB (tetraphenylbutadiene) forms highly conducting CTCS with organic acceptors. (TMTSF)$^{2}$ X compounds where X is acceptor are small band gap semiconductors with increase in the band width of conduction band. BEDT – TTF salts show two – dimensional character along with gaussian bands due to electronic delocalization.

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Decamethylferrocene (DMF) forms one-dimensional conducting systems having Peierls - Hubbard gap with organic acceptors. DMC (decamethylcobaltocene) and DMC+ PF6- form CTCS showing asymmetric gaussian bands or triangular distributions due to imperfect nesting.

2. Future Prospects:

The present study of magnetic organic conductors and potential organic ferromagnets leave immense scope for the future work in this direction. The CTCS can be again prepared studied mainly with magnetic susceptibility down to low temperature for establishing their ferromagnetic nature. Most of the spin density wave systems become antiferromagnetic at low temperatures. Also dynamic magnetic resonance measurements can be studied which can be related with magnetic phases of these materials. Magnetic contribution to specific heat can also be studied through calorimetric measurements. Shape effects in FMR and AFMR can also be studied on polycrystalline specimens of these magnetic materials. Electron Spin Resonance (ESR) can be also studied along with its temperature dependence to study itinerant magnetism of these materials. Magnetic hysteresis curves can also be studied down to low temperature related with power losses in these materials. Magnetic powder patterns and magnetic force microscopy can reveal presence of magnetic domains.
3. Applications:

If many CTCS studied in the present work were found to be magnetic at low temperature, they could be used wherever ferrites and iron garnets are used. These applications include transformers, magnetic tape recorders, Faraday devices, non-reciprocal devices, motors memory devices, CCD-type cameras, magnetic bubble domain based devices, etc. Ferrites and iron garnets have also remarkable microwave properties. Ferrites are placed in microwave waveguides and resonance cavities and propagation of microwave are studied. Such studies can also be carried out using organic ferromagnets. Hysteresis losses and heat losses are related with spin waves in magnetic materials. Dispersion relations of magnons (quantized spin waves) can be studied using neutron diffraction. The dispersion relations differ depending upon whether material is ferromagnetic, anti-ferromagnetic or ferrimagnetic. If magnetostriction is found in any organic ferromagnets such a material can have shape–memory effect.