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Surface induced assembly of PTZ-TCNQ complex and its charge transport characteristics

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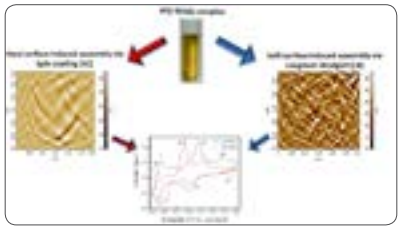
Tailoring of physical properties of π-framework containing organic molecules by tuning their non-covalent interactions is an intensive research area. Non-covalent interactions among organic molecules can be intervened to assemble them preferably via solution based processing methods. These solution processable materials can then be assembled with varying morphology thus procuring appropriate physical properties requisite for the application desired. We are more interested in processing organic synthetic metals for large area thin film based device applications. Organic charge transfer materials particularly those containing 7,7,8,8-tetracyano-p-quinodimethane (TCNQ) as one precursor are in current scientific interest due to its intrinsic ($TCNQ^-$) radical anion formation and astonishing electrical properties when complexed with strong donors like tetrathiafulvalene (TTF), phenothiazine (PTZ), etc. Besides these gains, these complexes carry a limitation of not forming flexible, uniform and ordered large area film in their pristine state thus restricting themselves in electronic device applications. Here, it is a motivation to investigate morphology controlled assembly of donor-acceptor PTZ-TCNQ charge transport complex on solid (hard) and liquid (soft) surfaces and their film formation. We have studied their surface (liquid and solid) induced assembly via spin casting and Langmuir technique. Films fabricated from both soft and hard surfaces depicted variation in crystalline morphology and surface topography that has been studied via SEM, TEM and AFM characterizations. These assembled large area films have also shown variation in electrochemical properties and charge transport characteristics as per their molecular arrangement and their stacking/orientation on the substrate. The main purpose of this study was to substantiate the significant effect of surface induced processing methodology on the assembly of the PTZ-TCNQ complex and its charge transport characteristics. We believe this study may open new dimension towards large area based organic electronics device application of TCNQ based organic metals.



Recent Publications:

1. Zhang J, Gu P, Long G, Ganguly R, Li Y, Aratani N, Yamada H and Zhang Q (2016) Switching charge-transfer characteristics from p-type to n-type through molecular "doping" (co-crystallization). Chem. Sci. 7:3851–3856.
2. Wu H D, Wang F X, Zhang M and Pan G B (2015) Investigation of transport properties of coronene-TCNQ cocrystal microrods with coronene microrods and TCNQ microsheets. Nanoscale 7:12839-12842.
3. Krupskaya Y, Gibertini M, Marzari N and Morpurgo A F (2015) Band-like electron transport with record-high mobility in the TCNQ family. Adv. Mater. 27:2453-2458.
4. Tseng H H, Serri M, Harrison N M and Heutz S (2015) Thin film properties of tetracyanoquinodimethane (TCNQ) with novel templating effects. J. Mater. Chem. C 3:8694.
5. Zhu L, Yi Y, Fonari A, Corbin N S, Coropceanu V and Brédas J L (2014) Electronic properties of mixed-stack organic charge-transfer crystals. J. Phys. Chem. C 26:14150-14156.

Biography

Richa Mishra has her expertise in self-assembly and processing of various organic materials for large area film formation via various techniques such as spin coating, Langmuir-Blodgett and Langmuir-Schaeffer. Her successful effort in the area of ordered film fabrication of non-alkyl chain conducting polymers and other π- conjugated materials has been recently recognized

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