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Title of the talk:Surface Science of Molecular Solids and Liquids
Time : 12 noon at CV Raman Hall

Abstract
The two emerging aspects of surface science are the topic of discussion in this seminar: one is surface science of molecular solids which is a fundamental area of research and relevant to the chemistry of interstellar medium (ISM) and another expanding area of research theme is surface science of ionic liquids (ILs), the application of this research towards catalysis and thin film technologies.

Despite the low temperature and pressure conditions, there is rich chemistry in the ISM which is composed of molecular solids. Several fundamental properties of molecular solids starting from their chemical reactions to their physical characteristics will be discussed. Various spectroscopic techniques have been successfully employed to explore properties like phase transition, segregation, diffusion, etc.1-4 Catalytic effects of molecular solids have been investigated by doping such molecular solids by small amount of metal atoms at cryogenic conditions and in this area a term “cryo-catalysis” has been coined by our group. Recently, we have demonstrated that these molecular solids are able to form clathrate hydrates (CHs) in ultra-high vacuum (UHV) and cryogenic temperature.4 This is the first time report of CHs formation in such extremely low temperature and pressure conditions analogous to the ISM.

The second theme is to study of surface and interface properties of ILs. ILs have been chosen as model systems for liquids in general for two reasons: First, their structural diversity allow tailoring their properties over a wide range, and second, they can be studied using the extremely powerful methods of surface science in UHV due to their low vapor pressure. To obtain molecular level information of such system, we utilize angle resolved X-ray photoelectron spectroscopy (ARXPS) which provides information of the bulk and near-surface region of the ILs.5-8 We have been exploring the growth of IL as well as their mixtures on single crystal surface in different experimental conditions; time and temperature-dependent experiments.6,7 I will also present our recent development of the unique state-of-the-art UHV setup, that is, a dedicated molecular beam chamber which combines a supersonic molecular beam with a rotatable mass spectrometer and an X-ray photoelectron spectrometer. The instrument will be used to investigate dynamical processes at ILs interfaces.

References:

1. Bhuin, R. G. et al. J. Phys. Chem. C 2016, 120, 13474-13484.
2. Bhuin et al. J. Phys. Chem. C 2015, 119, 11524-11532.
3. Bhuin et al. J. Chem. Phys. 2014, 141, 231101/1-231101/4.
4. Ghosh et al. Proc. Natl. Acad. Sci. USA, 2018, (just accepted).
5. Bhuin et al. J. Mol. Liq. 2019, 275, 290-296.
6. Lexow et al. Langmuir 2018, DOI: 10.1021/acs.langmuir.8b03517.
7. Lexow et al. Phys. Chem. Chem. Phys. 2018, 20, 12929-12938.
8. May et al. J. Phys. Chem. Lett. 2017, 8, 1137-1141.

All are cordially invited to attend the lecture