Characterization of the Conductive Polymer- Ionic Liquid Composites by FT-IR and UV-Vis

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Conductive polymers and room temperature ionic liquids (ILs) are materials with intrinsic properties. ILs are organic salts that are non-volatile, non-flammable, and remain liquid at a large range of temperatures, whose capabilities as an electrolyte for electrochemical cells, and their interaction with gas molecules has already been studied by our lab. Conductive polymers (CP) are often regarded as polyions after they are doped. CPs can be easily synthesized through chemical or electrochemical oxidation in IL electrolytes, and their molecular chain structure can be modified conveniently by copolymerization or structural derivations. CPs has been utilized as gas separation membranes and as the active layers of conductivity/resistivity gas sensors since the early 1980s. Recently work in our lab shows that conductive polymer Polyaniline that was immobilized with butylmethylimidazolium camphorsulfonate (BMICS) ionic liquid shows superior sensitivity and selectivity for methane absorption than either one alone. We believe that through a specific combination of ILs and CPs, we will be able to design the properties of each individual component to have a synergistic effect for various applications including coatings for sensors, membranes for fuel cells, and a solid electrolyte material. The aim of this research is to obtain more fundamental information on the interaction of conductive polymers, ILs, and conjugates formed when the two are mixed, with gas molecules. Because gas molecules are so important for various aspects of chemistry, the interactions shown could lead to advancements and improvements on preexisting and creation of new electrochemical devices such as fuel cells, batteries, solar cells, and bio-sensors. We focused our study on a fluorescent pH sensitive IL, $[P14,666]_3$[pyranine] which acts as a base, and the polymer Polypyrrole (PPy) which has acidic protons. The resulting mixture undergoes an unexpected color change, which hopefully will be understood by our spectroscopy study. The PPy, IL, and their conjugate are studied in a gas flow cell with a Fourier Transform Infrared spectrometer (FT-IR) and UV-vis.