Design of Organic Ionic Plastic Crystal based Liquid Crystal Gas Sensor with Tailored Selectivity and Sensitivity

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Due to extraordinary sensitivity on a variety of stimuli, Liquid Crystal (LCs) have been widely used for the design of gas sensor. Especially, anisotropy-driven amplification properties of LCs enable high sensitivity, fast response, and low cost. However, selectivity issues have been pointed out. To overcome this limit, we report a new type of highly selective LC gas sensor with wide designing rule using imidazole based Organic Ionic Plastic Crystal (OIPC). Specifically, imidazolium groups in an OIPC layer selectively adsorb gas molecules with carboxylic group (e.g., acetic acid) and change the molecular ordering of overlying LCs, leading to macroscopic optical output. In addition, we found sensitivity of the sensor can be precisely modulated by controlling carbon chain length and type of counter ion in OIPC. Overall, our results provide insight into the rational design of gas sensors with high selectivity and sensitivity.

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