**Self-powered Chemical Sensing with Light-activated Halides Perovskites**

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The development of portable devices for monitoring personalized healthcare, toxic gas emission and public space safety is driving a renaissance in solid-state sensor technologies.1 In addition to metal oxide semiconductor, recently, the prominent feature of lead halide perovskite as one promising light harvester for many optoelectronic applications, some new features (including chemical sensing and interface charge properties) have also been reported,2 which holds a great promise in widening the application of lead halide perovskite materials. Here, we present some perovskite based chemical sensors for chemical sensing without any applied external bias for the first time.3 As demonstration, a device consisting of non-passivated FA0.80MA0.15Cs0.05PbI2.55Br0.45 (FMCPIB) nanocrystals shows high selectivity and swift response and recovery time (trs=16.7 s, trc=126.1 s) for the detection of particle per million (ppm) concentrations of NO2 with no obvious sensor response to other analyte gases at room temperature (30 oC) (Fig. 1). This devices can be operated under self-powered mode (zero external bias or short-circuit mode) for chemical sensing of NO2 under multiple kinds of light excitations (fluorescent lamp light or monochromic light with different wavelengths) at room temperature, where the light-generated power is used as the driving power. More interestingly, this self-powered devices remain operational for the detection of NO2 as long as 1.7 hours in dark condition, revealing an appealing self-charging and storage feature inherited in FMCPI based chemical sensor devices. Besides, the devices can also be operated under 1 V of applied external voltage and the detection limit for NO2 can reach as low as 0.2 ppm at room temperature. These distinctive features revealed on this FMCPIB based chemical sensor devices including room-temperature and self-powered operation, self-charging and storage ability, swift response and recovery time, and extraordinary selectivity for NO2 detection make it as an excellent candidate in chemical sensor family with a great potential application in monitoring the toxic gas emission and public space safety.

Fig. 1. Schematic illustration of a FMCPIB based chemical sensor. a, Schematic of NO2 gas sensing by the FMCPIB device. b, Energy level diagram of the FMCPIB device, showing photoexcited electron injection and hole extraction.

**References**

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