Supplementary information for

# High charge carrier mobility in solution processed one-dimensional lead halide perovskite single crystals and their application as photodetectors

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**Optical image of synthesised crystals**

**Figure S1.** Optical image of the synthesised crystals in vial. Scale bar is 10 mm.

**The statistical analysis of the crystal length**

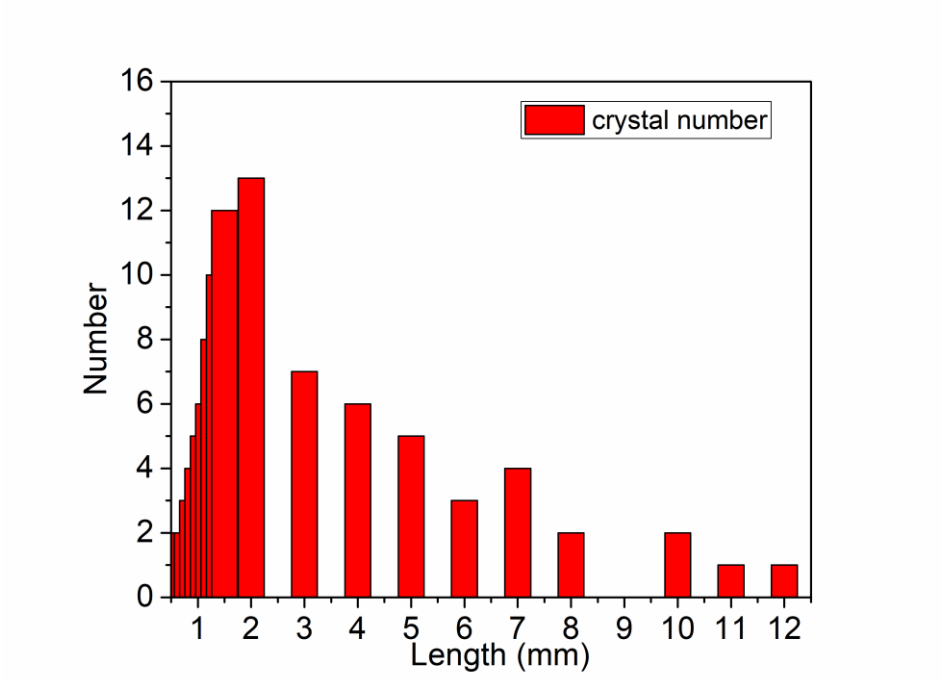


**Figure S2.** Statistical analysis of the length of the synthesised crystals.

**Photodetector ON and OFF times**

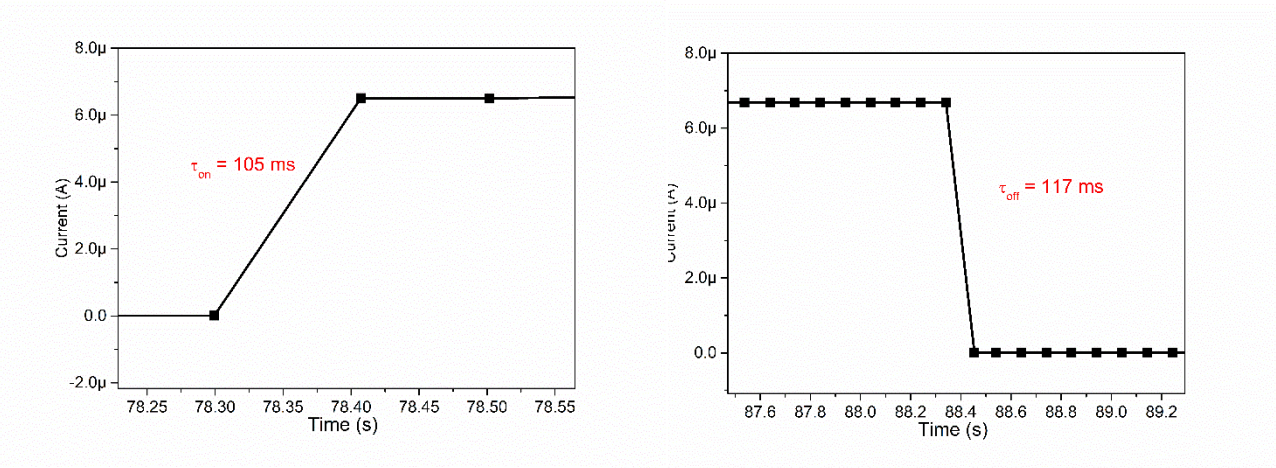


**Figure S3.** Photodetector response times. The response times marked for (left) ON and (right) OFF are an upper limit based on the time interval of the measurement.

**Synthesis of $MAPbBr_3$ single crystals**

The method of single crystal growth of $MAPbBr_3$ has been adapted from the literature.[1] Lead bromide ($PbBr_2$), Methylammonium bromide (MABr) and N,N-Dimethylformamide (DMF) were purchased from Sigma Aldrich and used without further purification. A 1M solution containing $PbBr_2$ and MABr was prepared in DMF. This bromide solution was prepared at room temperature and the solutions were filtered using a PTFE filter with 0.2-µm pore size. Two millilitres of the filtrate were placed in a vial and the vial was kept in an oil bath undisturbed at 80 C° during crystal growth. The crystal growth took around 6 h. All procedures were carried out under ambient conditions.

**Table S1.** A summary of UV responsivity in perovskite photodetectors

| perovskites | responsivity (A $W^{-1}$) | Illumination wavelength /intensity (mW $cm^{-2}$) | response speed ON/OFF time | reference |
|---|---|---|---|---|
| $CH_3NH_3PbCl_3$ | 0.05 | 365 nm /1000 | 24 ms / 65 ms | 2 |
| $CH(NH_2)_2PbI_3$ | 0.68 | 380 nm /0.5 | 12.4 ms / 17.2 ms | 3 |
| $CH_3NH_3PbI_3$ | 3.49 | 365 nm /0.01 | 0.2 s | 4 |
| $CH_3NH_3PbCl_3$ | 7.56 | 360 nm /0.1 | 170 ms / 220 ms | 5 |
| $CH_3NH_3PbCl_3$ | 18 | 385 nm /$4\times10^{-6}$ | 1 ms | 6 |
| Our work | 132.3 | 375 nm /0.001 | <105 ms / <117 ms | |

**Table S2.** Charge carrier mobility perovskite nanowires and 1D crystals

| perovskite | architecture | method | Mobility $cm^2/Vs$ | ref. |
|---|---|---|---|---|
| $MAPbI_3$ | nanowire | FET | 0.01 | 7 |
| $CsSnI_3$ | nanowire | FET | 0.09 | 8 |
| $CsPbI_3$ | nanowire | spectroscopy | $3 \pm 1$ | 9 |
| Our work | 1D crystal | SCLC | 4.5 at 300 K<br>9.2 at 120 K | |

**References**


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