Supporting Information for:

Laser Direct Write Synthesis of Lead Halide Perovskites

Stanley S. Chou†,*, Brian S. Swartzentruber‡, Matthew T. Janish§, Kristin C. Meyer‖,
Laura B. Biedermann†, Serdal Okur⊥, D. Bruce Burckel†, C. Barry Carter†,§ and Bryan Kaehr‖,#,*

†Sandia National Laboratories, Albuquerque, NM 87185, United States, United States; ‡Center for Integrated
Nanotechnologies, Sandia National Laboratories, Albuquerque, NM 87545, United States; §Department of Materials
Science & Engineering, University of Connecticut, CT 06269, United States; ‖Advanced Materials Laboratory,
Sandia National Laboratories, Albuquerque, New Mexico 87106, United States; ⊥Department of Electrical and
Computer Engineering, the University of New Mexico, Albuquerque, New Mexico 87131, United States;
#Department of Chemical and Biological Engineering, the University of New Mexico, Albuquerque, New Mexico
87131, United States

correspondence to: schou@sandia.gov; bjkaehr@sandia.gov
Figure S1. Top down and tilt views of scanning electron microscopy (SEM) images of two CH$_3$NH$_3$PbBr$_3$ structures grown on platinum (arrows). Crystals surrounding these two structures are the result of solution precipitation during drying. The asterisk shows a visual reference point for orienting the two images.

Figure S2. X-ray diffractogram of the CH$_3$NH$_3$PbBr$_3$ materials examined in this work.

<table>
<thead>
<tr>
<th>Crystal System</th>
<th>cubic</th>
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<tr>
<td>Space group</td>
<td>$Pm3m$</td>
</tr>
<tr>
<td>$a$ (Å)</td>
<td>5.83</td>
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Figure S3. (a) Laser-induced fabrication of CH$_3$NH$_3$PbI$_3$ perovskite on platinum (left panels) forms opaque, multi-crystallite structures (right panels are snap-shots of structures undergoing heat-induced crystallization) displaying crystal habits indicative of rhombo-hexagonal dodecahedrons (arrows). (b) Optical images of a laser direct write line of CH$_3$NH$_3$PbCl$_3$ fabricated on sputtered carbon-functionalized coverglass shows the cuboid structure and optical transparency indicative of CH$_3$NH$_3$PbCl$_3$ perovskites.
Figure S4. (a) Optical images of the CH$_3$NH$_3$PbBr$_3$ materials (laser direct write, ‘LDW’, multi-crystalline line on sputtered carbon and bulk solution grown single crystal, ‘Bulk’) examined using time resolved photoluminescence. Individual decay data and fitting of the photoluminescent decay curves combined in Figure 2 (panel f) for (b) laser direct write CH$_3$NH$_3$PbBr$_3$ on sputtered carbon (c), bulk CH$_3$NH$_3$PbBr$_3$ on sputtered carbon, and (d) the same CH$_3$NH$_3$PbBr$_3$ crystal measured on an electrically insulating surface (polystyrene, PS).
Figure S5. (left panel) Plot showing the dark current charge and discharge over time. The charge and discharge are nearly identical (right panel shows normalized curves) and can be fit by a stretched exponential function, $I(t) = e^\left(-t/\tau\right)^\beta$. The best fit for these data yield $\tau = 2.49$ s and $\beta = 0.54$. 