

## Solution-processed materials for optoelectronics

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Colloidal quantum dots and reduced-dimensional perovskites [1, 2, 5] each represent classes of liquid-synthesized and liquid-processed materials that have seen rapid performance advances in recent years. I will discuss progress in lasing, photodetection [3], light harvesting [4,7], and light-emitting diodes [6, 8] based on these emerging materials.

- [1] R. Quintero-Bermudez, A. Gold-Parker, A.H. Proppe, R. Munir, Z. Yang, S.O. Kelley, A. Amassian, M.F. Toney, E.H. Sargent, "Compositional and orientational control in metal halide perovskites of reduced dimensionality," *Nature Materials*, DOI:10.1038/s41563-018-0154-x, 2018.
- [2] H. Tan, F. Che, M. Wei, Y. Zhao, M.I. Saidaminov, P. Todorovic, D. Broberg, G. Walters, F. Tan, T. Zhuang, B. Sun, Z. Liang, H. Yuan, E. Fron, J. Kim, Z. Yang, O. Voznyy, M. Asta, E.H. Sargent, "Dipolar cations confer defect tolerance in wide-bandgap metal halide perovskites," *Nature Communications*, vol. 9, no. 1, 2018.
- [3] G. Long, C. Jiang, R. Sabatini, Z. Yang, M. Wei, L.N. Quan, Q. Liang, A. Rasmita, M. Askerka, G. Walters, X. Gong, J. Xing, X. Wen, R. Quintero-Bermudez, H. Yuan, G. Xing, X.R. Wang, D. Song, O. Voznyy, M. Zhang, S. Hoogland, W. Gao, Q. Xiong, E.H. Sargent, "Spin control in reduced dimensional chiral perovskites," *Nature Photonics*, vol. 12, no. 9, pp. 528-533, September 2018.
- [4] M.I. Saidaminov, J. Kim, A. Jain, R. Quintero-Bermudez, H. Tan, G. Long, F. Tan, A. Johnston, Y. Zhao, O. Voznyy, E.H. Sargent, "Suppression of atomic vacancies via incorporation of isovalent small ions to increase the stability of halide perovskite solar cells in ambient air," *Nature Energy*, vol. 3, no. 8, pp. 648-654, August 2018.
- [5] F.P. Garcia de Arquer, E.H. Sargent, "Perovskite nanowires find an edge," *Nature Electronics*, vol. 1, no. 7, pp. 380-381, July 2018.
- [6] X. Gong, O. Voznyy, A. Jain, W. Liu, R. Sabatini, Z. Piotkowski, G. Walters, G. Bappi, S. Nokhrin, O. Bushuyev, M. Yuan, R. Comin, D. McCamant, S.O. Kelley, E.H. Sargent, "Electron-phonon interaction in efficient perovskite blue emitters," *Nature Materials*, vol. 17, no. 6, pp. 550-556, June 2018.
- [7] J. Xu, O. Voznyy, M. Liu, A.R. Kirmani, G. Walters, R. Munir, M. Abdelsamie, A.H. Proppe, A. Sarkar, F.P. Garcia de Arquer, M. Wei, B. Sun, M. Liu, O. Ouellette, R. Quintero-Bermudez, J. Li, J. Fan, L. Quan, P. Todorovic, H. Tan, S. Hoogland, S.O. Kelley, M. Stefk, A. Amassian, E.H. Sargent, "2D matrix engineering for homogeneous quantum dot coupling in photovoltaic solids," *Nature Nanotechnology*, DOI:10.1038/s41565-018-0117-z, April 2018.
- [8] X. Li, Y. Zhao, F. Fan, L. Levina, M. Liu, R. Quintero-Bermudez, X. Gong, L.N. Quan, J. Fan, Z. Yang, S. Hoogland, O. Voznyy, Z.-H. Lu, E.H. Sargent, "Bright colloidal quantum dot light-emitting diodes enabled by efficient chlorination," *Nature Photonics*, vol. 12, no. 3, pp. 159-164, March 2018.