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Organic Photonic Crystal Lasers from Holographic Polymer Dispersed liquid Crystals (H-PDLCs) TIMOTHY BUNNING, RACHEL JAKUBIAK, DEAN BROWN, RICHARD VAIA, Air Force Research Laboratory, PAMELA LLOYD, UES, VINCENT TONDIGLIA, LALGUDI NATARAJAN, RICHARD SUTHERLAND, Science Applications International Corp. — Holographic polymerization of liquid crystal containing photopolymerizable resins enables one-step, rapid formation of multi-phase structures that exhibit partial photonic band gaps. These holographic polymer dispersed liquid crystals (H-PDLCs) provide a versatile platform for diffractive optical elements because the structures are not limited by multi-phase equilibrium but are controlled by the interference of multiple lasers at discrete angles. Incorporation of laser dyes into H-PDLCs form 1-D and 2-D optically pumped distributed feedback lasers. Linewidths as narrow as 1.8 nm are observed with laser thresholds below 1 mJ/cm^2 in 2-D columnar structures compared to 9 nm and 25 mJ/cm^2 exhibited by 1-D H-PDLC Bragg stack lasers. In the 2-D lattices the energy of the laser action can be tuned within the gain spectrum of the lasing medium by an applied electric field.

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