waveguide was coupled into a spectrometer and recorded with the PMT. Figure 4(b) shows the spectrum of the NQD lasing emission ($\lambda$ = 616nm) when the excitation energy was greater than the threshold value. The inset in Fig. 4(b) plots the integrated emission intensities as functions of the excitation energy for two NQD DFB lasers containing InP/ZnS core-shell nanocrystals with 616nm and 600nm diameters, respectively. The threshold behavior of the optically pumped NQD lasing is clearly revealed in the plot with a threshold energy fluence ~2.0 mJ/cm$^2$.

In summary, we have observed, for the first time, amplified spontaneous emission and optical gain in close-packed InP/ZnS core-shell NQDs upon UV excitation. Moreover, the optical gain profile of InP/ZnS NQDs was matched to the second order feedback of holographic polymer-dispersed liquid crystal (H-PDLC) gratings, leading to the very first demonstration of an optically-pumped, nanocrystal laser based on these cadmium-free NQDs. The output color can be selected by tailoring the size of the InP-based nanocrystals as well as the corresponding grating periodicity.

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