Strong coupling phenomena in a $CsPbBr_3$ nanocrystal microcavity at 90K

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Lead halide perovskite nanocrystals (NCs) have recently attracted wide interest based on their facile and low-cost synthesis, solution-processability and remarkable optical properties.[1] Considering their robust exciton binding energies (20-75 meV for $CsPbX_3$ NCs, with X=I, Br, Cl),[2] pronounced strong coupling and polariton lasing phenomena can be expected in properly configured NC-containing microcavities. In a recent work, polariton lasing has been observed up to room temperature using bulk-like 400nm-thick $CsPbCl_3$ platelets, sandwiched between dielectric mirrors.[3] Achieving polariton lasing from a single layer of perovskite NCs is certainly more challenging compared to the bulk platelet case, but has a number of distinct advantages, such as precise position and thickness control of the active layer in the microcavity, relative ease of fabrication, and increased scalability of the produced polariton devices.

Here, we demonstrate for the first time, a full microcavity containing $CsPbBr_3$ NCs as the active medium, exhibiting strong-coupling effects at 90K. The microcavity consists of a λ/2-polystyrene layer containing $CsPbBr_3$ NCs, 4% w/w, spin-cast onto a bottom distributed Bragg reflector (DBR). The microcavity is completed by placing on top, using a stamping technique, a transferrable top-DBR membrane,[4] as schematically depicted in Figure 1. Evidence for strong coupling effects in the microcavity is presented in the angle-resolved photoluminescence measurement of Figure 2, showing a distinct discontinuity in the energy dispersion at about 20°, demonstrating the formation of lower and upper polariton branches. These novel polariton structures based on perovskite nanocrystals are very promising for the observation of polariton lasing at non-cryogenic temperatures, leading to a new generation of high temperature cost-effective nanophotonic devices.

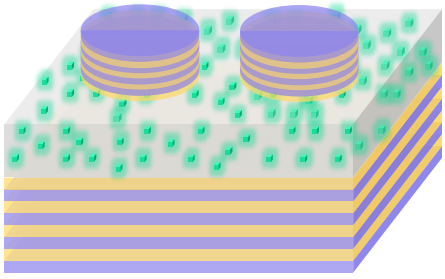

***Figure 1**: Schematic illustration of a microcavity containing CsPbBr3 NCs.*

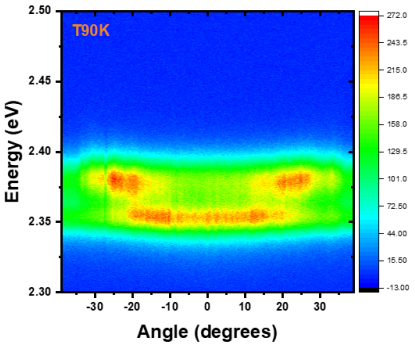

***Figure 2**: Angle-resolved photoluminescence of a $CsPbBr_3$ NCs microcavity*

References

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