Exciton-Photon Strong Coupling in All-inorganic Perovskite Metasurface

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Halide perovskites have been widely recognized as an excellent platform for exploring exciton-photon strong coupling regimes at room temperature. Among various approaches, subwavelength-scale perovskite metasurfaces offer precise engineering of light-matter interactions, enabling novel studies in this field. Recent advancements in hybrid organic-inorganic perovskite (HOP)-based metasurfaces have enabled exciton-polariton dispersion engineering [1], realization of polaritonic bound states in the continuum (BICs) [2], and long-range polariton propagation [3]. However, HOPs suffer from inherent stability limitations and have yet to demonstrate polariton lasing. On the other hand, most reports of polariton lasing have been observed in all-inorganic perovskites (AIPs), which offer enhanced chemical stability; but these studies have so far been limited to bulky microcavities. In this work, we fabricated $CsPbBr_3$ metasurfaces, using two methods: 1) Spincoating on a flat substrate followed by direct thermal nanoimprint at high pressure [4]; 2) Spin-coating on a pre-patterned substrate followed by recrystallization under high pressure (Figure 1a). As a result, the strong coupling regime is revealed in both angle-resolved reflectivity and photoluminescence measurements (Figure 1b), with Rabi splitting of approximately 180 meV. These findings highlight the potential of $CsPbBr_3$ metasurfaces for advanced photonic applications, paving the way for next-generation polariton-based devices. Moving forward, the next step involves exploring polariton lasing and condensation.

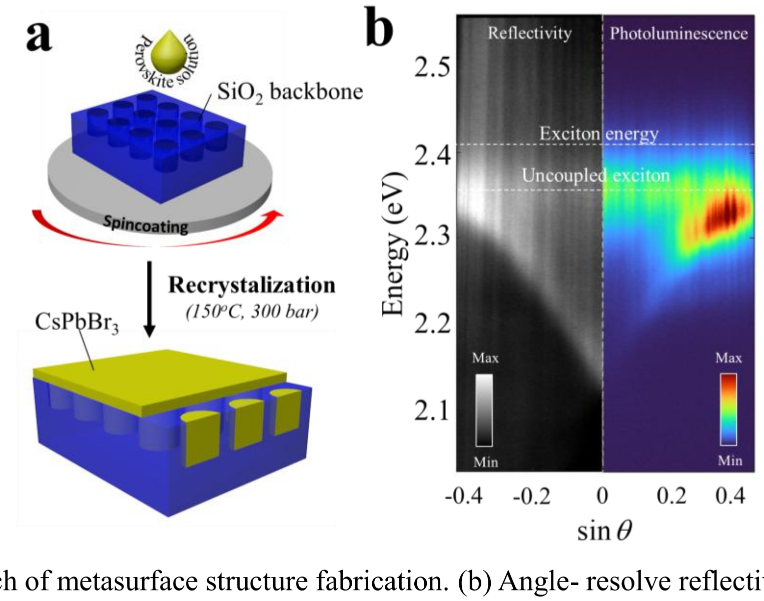

Figure 1: (a) Sketch of metasurface structure fabrication. (b) Angle- resolve reflectivity (left) and photoluminescence (right) of CsPbBr3 metasurface.

Acknowledgments

The authors thank the staff from the NanoLyon Technical Platform for helping and supporting in all nanofabrication processes. This work is partly supported by the French National Research Agency (ANR) under the project POLAROID (ANR-24-CE24-7616-01).

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