

System design of solar-to-steam generation with efficiency > 90% at one sun

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To achieve high solar-driven steam generation rate, the interfacial evaporation system with black Au-based cellulose is constructed. The absorption of the system is boosted to 92.8% by placing the absorber on the light reflective insulator, so the transmitted light can be reflected back to the absorber for recycling purposes. The water-feed component of the system is carefully optimized to establish a favorable balance between amounts of water coming and leaving the system. This steady-state strategy allows to minimize contribution of energy-loss mechanisms of the system. As a result, the developed system exhibits excellent stability and performance, including 2 kg/m²h evaporation rate under 1 sun, continuous operation for 168h without any decay in performance and excellent resistance against aging. The system proposed in this work not only shows highest evaporation rate achieved for plasmonic-based evaporators but features an inexpensive configuration for accurate measurement of the solar to steam generation values that can be later compared between various research groups.