Au-Ag Nanoparticle and Cellulose Micro/nanofiber Composite Film for Highly Efficient Solar-to-Steam Generation

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The recent advances in solar-to-steam generation system are focused on the development of an efficient light absorbing material that is able to utilize the wide spectrum solar energy and convert it into heat. As the efficient photo-thermal convertors, metal nanoparticles with localized surface plasmon effect have been widely proposed. Particularly, gold (Au) and silver (Ag) nanoparticles (NPs) are considered to be the most efficient plasmonic materials.

In this study, the center of our attention is the optimization of the size and the morphology of Au and Ag NPs for the broadband absorption solar light. To fabricate a photoactive, hydrophilic and porous membrane with a good mechanical strength, Au and Ag NPs were composited with natural cellulose macro- and nano-fiber mixture. Polyethyleneimin (PEI) was used as both a capping ligand and a reducing agent in order to control the physical parameters of Au and Ag NPs such as shape and size. In addition, PEI enhanced wettability and wet-strength of composites resulting in the efficient solar-to-steam generation.