Development of cost-effective light absorber based on black-titania/glass fiber for efficient solar desalination and solvent recovery

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The development of cheap and sustainable photothermal absorbers has attracted tremendous attention due to their wide applications for solar desalination and solvent recovery. Titanium is the ninth most abundant element on our planet and its most common configuration is TiO_2, which is also known as titania. In this study, using vacuum annealing we introduce oxygen vacancies into TiO_2 lattice, which changes natural white color into deep black. Oxygen vacancies present a confined (defect) state in the bandgap, which acts as longer (as compared to bulk TiO_2) wavelength light absorption centers. Developed black titania (B-TiO_2) nanopowders exhibit broadband light absorption in the solar spectrum. The UV-Vis-NIR spectrophotometry showed that over 95% of incident light is being absorbed by B-TiO_2. Changes in electronic and crystal structure of the TiO_2 upon annealing were studied by the XPS and XRD respectively. For the solar-to-steam application, we manufacture light absorber via two-step process: first the samples was dipped into white TiO_2 solution, then samples were transferred to tubular vacuum furnance for annealing it.