A Novel Approach for the Preparation of High Efficiency Water Splitting Photocatalysts

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The total solar energy absorbed by the Earth is 3.85 × 1024 J per year, which is approximately 104 times greater than the annual world energy consumption. Solar energy must be harvested to produce renewable energy capable of replacing environmentally harmful energy sources such as fossil fuels. This project aims to significantly increase the efficiency for overall water splitting because the current production of H2 is too low to be applied at the industrial scale. This was achieved by initially testing the effect of four different noble-metal based cocatalysts deposited over SrTiO3, which was used as an ideal UV light responsive photocatalyst. To ensure high crystallinity of the SrTiO3, the photocatalyst underwent a flux-assisted heat treatment method. The photocatalyst was then impregnated with noble-metal cocatalyst nanoparticles (Pt, Rh, Pd, and Ir) through wet impregnation. A CrOx layer was deposited around the nanoparticles to prevent O2 and H2 recombination. The activity for each metal/SrTiO3 photocatalyst was then tested. Rh exhibited the highest yield, producing an average rate of 240 μmol h–1 for H2 and 120 μmol h–1 for O2 under high power Xenon lamp. This is 8 times more gas than the next best noble metal (Pt). Rh/SrTiO3 photocatalyst sheets were then engineered and tested in dense buffer solution 6 times; successfully improving the photocatalytic activity. This research is a step forward towards the understanding of photocatalysis and therefore progressing to the objective of developing practical water splitting photocatalysts. This will offer a potential solution to the world’s growing energy demands.

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