Transition metal nitrides including titanium nitride (TiN) and zirconium nitride (ZrN) are highly conductive ceramic and chemically stable. Through non-radiative decay processes enhanced by plasmonic resonances, hot carriers are excited in transition metal nitrides by visible light excitation to facilitate photoelectric and photothermal conversion.

• Excite hot carriers from transition metal nitrides by visible light
• Inject carriers into wide bandgap oxides from transition metal nitrides by visible light
• Demonstrate highly efficient photothermal conversion in transition metal nitrides upon sunlight incidence

Advanced Research Topics

• Photocurrent generation from a TiN thin film upon visible light incidence
• Carrier injection into a wide bandgap oxides with low energy photons by hot carrier excitation from TiN

Publications

• M. Kumar, et al, ACS Photonics, 3, 43-50 (2016)

Summary

First experimental demonstration of hot carrier excitation from TiN
Carrier injection into a wide bandgap oxide by visible light illumination
Highly efficient (~ 90 %) photothermal conversion of sunlight using TiN nanoparticles

Research outcome

Visible light photocatalysis and solar water splitting using transition metal nitride nanostructures
Develop efficient solar water heating system as well as solar water distillation setup
Deep and systematic understanding of hot carrier excitation in transition metal nitrides for energy applications

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