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Physical property control of nanoparticles for effective light-energy use SUNGSOOK AHN, SUNG YONG JUNG, SANG JOON LEE, Pohang University of Science and Technology (POSTECH), POSTECH TEAM — Up-to-now only limited materials are useful for solar energy harvesting, which makes the expansion of available photoactive materials important. In this point of view, physical property control is one of the reasonable solutions rather than creation of new materials. In this study, as a representative light-responsive metal nanoparticle (NP), gold NPs of a fixed size (average diameter of 20 nm) are surface-activated in pH-controlled aqueous solutions or chemically cross-linked, followed by electron-beam treatment. Chemical-interlinking of NPs behaves like a polymerization, generating characteristic structures (Fractal dimension). The absorbance at UV-vis and THz regions are significantly modified depending on the surface-modification and controlled cluster structures of NPs. Electron beams of different doses are applied to change the surface energy of NPs forming a specific surface layer (proximity length) and the structural modification of NP clusters. This changes the absorption energy band toward shorter-wavelength UV-vis light, benefiting solar energy harvesting. This study contributes to fundamental understanding on nanoparticle technology and provides general information for new metamaterial design for effective light energy use.

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