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Photo-catalytic reduction of CO_2 using Au–ZnO heterostructured nano-pyramids OSHADHA RANASINGHA, Department of Physics, West Virginia University, Morgantown / National Energy Technology Laboratory, U.S. Department of Energy, Pittsburgh, PA 15236, CONGJUN WANG, URS Corporation, South Park, PA 15129 / National Energy Technology Laboratory, U.S. Department of Energy, Pittsburgh, PA 15236, CHRISTOPHER MATRANGA, National Energy Technology Laboratory, U.S. Department of Energy, Pittsburgh, PA 15236, JAMES LEWIS, Department of Physics, West Virginia University, Morgantown / National Energy Technology Laboratory, U.S. Department of Energy, Pittsburgh, PA 15236
— Au-ZnO heterostructures were synthesized to create Au nanoparticles ($\sim$ 5 nm) attached to the basal surface of pyramid-shaped ZnO nanocrystals ($\sim$ 20 nm). The Au-ZnO heterostructures showed a large absorption peak around 521 nm which is assigned to the surface plasmon resonance of the Au nanoparticles. The photocatalytic activity of the Au-ZnO sample was evaluated inside a reaction cell purged with a 50 % CO_2 and 50 % H_2 gas mixture. The sample was then exposed to a 532 nm pulsed laser source to excite the plasmon resonance of Au and generate heat to drive the catalytic reaction of CO_2 and H_2 on the ZnO substrate. The primary products detected with gas chromatography were CO, CH_4 and C_2H_6. A maximum CO_2 conversion rate of 43.15 μ mol $g^{-1}h^{-1}$ was observed at the available highest laser power.

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