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Controlled Introduction of Nitrogen Species to Improve Nano-functionality XIUJUAN (JANE) DAI, YING CHEN, TAO TAO, ZHIQIANG CHEN, LUHUA LI, PETER LAMB, BRONWYN FOX, XUNGAI WANG, Institute for Technology Research and Innovation, Deakin University — The incorporation of nitrogen (N) species into nanomaterials has played an important role in biomedicine, solar energy, environmental cleaning, optical and electrical devices etc. N-doping of semiconductor oxides (e.g. TiO_2) has been shown to increase photocatalytic activity and reduce band gaps. Incorporation of N into CNTs has been shown to enhance conductivity and surface chemical activity. However, controlled introduction of a sufficient density of the desired N-species and determination of the mechanisms are still major challenges. A novel combined plasma mode has been developed that allows control of the required N-species or N-functional group and its incorporation into a range of nanomaterials (TiO_2, SnO_2, CNTs, BNNTs etc.). The N-containing precursor is selected and the process parameters are designed for the specific application (solar cell, biosensor, nanocomposite etc.). Ion bombardment and UV radiation from continuous wave plasma provides surface etching to produce bond scission or introduce free radicals on the substrate. Pulsed plasma introduces the required N-species onto the sites without disturbance from charged particles and UV radiation. The detailed N chemical states in the selected nanomaterials have been studied by XPS to help understand their chemical nature and effects on the improvement of visible-light response, conductivity and surface chemical activity.

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