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Enhanced Photocatalytic Activity of TiO2 Nanoparticles by Copper and Silver Codoping

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The large band-gap of Titania, and the high recombination of photogenerated charge carriers that limit its overall photocatalytic efficiency, prompted the systematic investigation of copper and silver, doped and codoped, TiO₂ nanocatalysts. In the study, four different TiO₂ nanopowder species, namely undoped, Cu-doped, Ag-doped and Cu+Ag-doped, were fabricated via the sol-gel route for the activity assessment. After drying at 100^oC, the powder samples were annealed for one hour at temperatures of 300^oC, 600^oC, 900^oC and 1100^oC. Analysis by XRD revealed that TiO₂ was effectively doped, and that the anatase – rutile mixed-phase occurred around 600^oC. Brookite-bearing, mixed-phases (anatase – brookite, brookite – rutile) appeared in the 300^oC and 600^oC of the codoped samples. UV-vis indicated a shift of the absorption edge to a lower energy and a stronger absorption in the visible light region for these two samples, the highest quantum efficiency being induced by the former. Photoluminescence (PL) spectroscopy suggests that these high activity photocatalysts produced lower PL spectra intensities. The visible emission observed were attributed to the enhancement of oxygen and Ti vacancies by the presence of the brookite phase.

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Primary authors: Mr NUBI, Olatunbosun Nubi (University of Limpopo); Dr MOSUANG, Thuto (University of Limpopo)

Presenter: Mr NUBI, Olatunbosun Nubi (University of Limpopo)

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