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Mechanistic Investigation of GPx-like Activity of V_2O_5 Nanozymes

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Abstract: Enzymes such as superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) play key roles in protecting cells from oxidative damage by maintaining the level of reactive oxygen species (ROS) such as hydrogen peroxide (H_2O_2) and superoxide (O_2^-) below the toxic level. Nanomaterials with enzyme-like activity (nanozymes) attract significant interest due to their catalytic efficiency, robustness and therapeutic potential.

In this work, four different morphologies (wire, sheet, flower, and sphere) of GPx-mimetic V_2O_5 nanozymes have been synthesised and their activity was checked using glutathione reductase-coupled GPx assay. Thorough characterisation indicated that, even though the structure of V_2O_5 remained the same in all four morphologies, the crystal planes exposed on their surface differed, which ultimately led to the difference their catalytic efficiency, suggesting that the nanomaterial surface can be engineered to fine-tune their reactivity. Additionally, the active species involved in the catalytic cycle was identified by monitoring the reaction *in-situ* using time-dependent Raman spectroscopy.

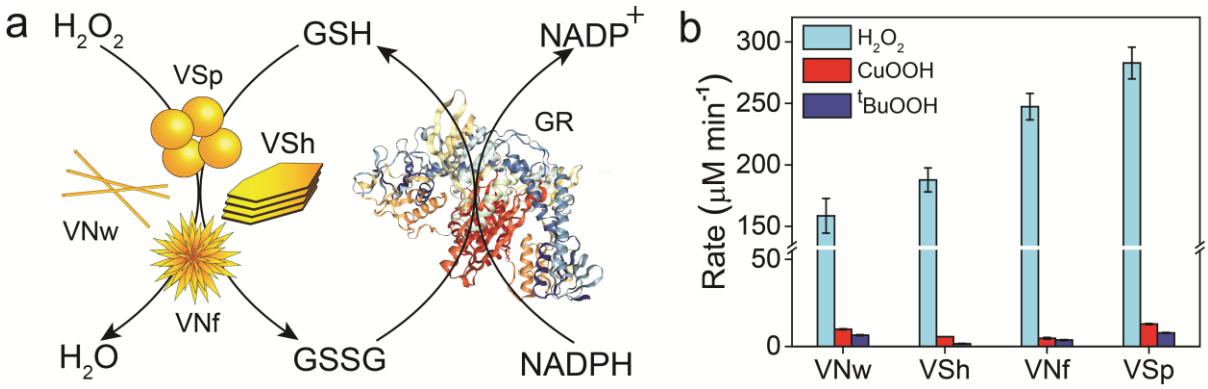

Figure: a) Schematic of GR-coupled GPx activity assay. The reaction was monitored by following the decrease in the absorbance of NADPH at 340 nm. b) Comparison of GPx-like activity of the nanozymes, in terms of initial rate of reaction, using three different peroxides (hydrogen peroxide, cumene hydroperoxide, and *tert*-butyl hydroperoxide).

References and Notes:

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