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Intra- and Post-Synthesis Optimization of thermochromic α-NiS Nanoparticles

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When designing new materials, one promising strategy is to combine different components to create sensitive or tunable physical and chemical properties. Nanomaterials that exhibit intrinsic functional responses –such as electrochromic, thermochromic, or photochromic behavior –play an important role in advancing innovative material technologies, particularly in electrochemical, catalytic, or sensing applications. A notable example is alpha-nickel sulfide (α-NiS)[1], which is recognized for its tunable thermochromic characteristics that can be tailored through precise synthesis methods and careful control of phase purity. In this study, we systematically investigate how varying synthesis parameters influence the formation of α-NiS nanoparticles, their subsequent transfer into polar solvents, and how these processes impact factors such as colloidal stability, particle aggregation, and the resulting thermochromic response. Comprehensive characterization using transmission electron microscopy (TEM), dynamic light scattering (DLS), and UV-visible spectroscopy –including cryogenic measurements –is employed to robustly evaluate the structural and functional properties, as well as the dispersion stability of the nanoparticles. This integrated analytical approach provides a solid foundation for the targeted investigation and future application of stimuli-responsive nanostructures and hybrid material systems. Looking ahead, additional promising candidates such as tungsten trioxide (WO_3)[2] will be considered for further studies due to their favorable properties for tunable materials.

[1] R. Himstedt, D. Baabe, C. Wesemann, P. Bessel, D. Hinrichs, A. Schlosser, N. C. Bigall, D. Dorfs, J Phys Chem C Nanomater Interfaces 2021, 125, 26635-26644.
[2] S. Heo, J. Kim, G. K. Ong, D. J. Milliron, Nano Lett 2017, 17, 5756-5761.

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