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Thermal Decomposition of Nickel(II) Tetraphenylporphyrin: Core-Shell Nanoparticle Synthesis, Characterization, and Magnetic Properties

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The exploration of Nickel(II) Tetraphenylporphyrin (NiTPP) under thermal decomposition provides crucial insights into the synthesis of novel magnetic materials with potential applications in nanotechnology and biomedical applications. Building upon our established research on the synthesis and characterization of iron porphyrin and iron phthalocyanine nanoparticles, this study investigates the structural evolution and magnetic behavior of NiTPP subjected to solid-phase pyrolysis at varying temperatures (300°C - 900°C) and times (10 - 240 minutes). Through a range of characterization techniques, including Powder X-ray Diffraction (PXRD), Physical Property Measurement System (PPMS) with Vibrating Sample Magnetometry (VSM), and Scanning Electron Microscopy (SEM) we attempt to interpret the interplay between pyrolysis conditions and the resultant nanoparticle properties. The emergence of magnetic core-shell structures and the impact of subsequent annealing in oxygen and nitrogen atmospheres on the nanoparticles' morphology and magnetic properties are investigated. As we compare our initial NiTPP findings with previous work, our goal is to replicate and refine synthesis procedures for various metal centers including cobalt, copper, and zinc within the porphyrin matrix. In doing so, we attempt to identify pathways that allow the tailoring of morphology and magnetic characteristics in nanoparticles.

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