Chalcopyrite with Magnetic and Dielectric Properties: An Introductory Catalyst for 4-Nitrophenol Reduction

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Abstract

The progress for the development of active, stable, and economic catalysts for the chemical transformation of noxious chemicals to benign is of primary importance. The synthesis of surfactant-free chalcopyrite, **sf-$CuFeS_2$**, by a wet-chemical one-pot hexam ethyldisilazane-assisted synthetic method was accomplished. Various analytical and spectroscopic techniques were used for the physical characterization of the material produced. From the observation of magnetic properties, the material chalcopyrite was found to be paramagnetic. The dielectric constant and dielectric loss were also determined and were found to be decreasing with an increase in frequency. The dielectric

behaviour of the material was explained by the Maxwell–Wagner theory of polarization, and the dielectric constant of the as-synthesized sample was found to be 3.176 at 100 °C and 500 kHz. The potential catalytic activity was confirmed by performing the reduction of 4-nitrophenol (**4-NP**) to 4-amino phenol (**4-AP**) in the presence of sodium boro hydride ($NaBH_4$) in aqueous medium at room temperature. The catalyst showed about 90% yield in the reduction reactions, which can be attributed to easy access to active sites invigorated by the absence of surfactant molecules. The reusability of the catalyst was checked to find out the stability, and excellent retention of activity up to five cycles was observed.