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Speciation of Iron(III) Oxide Nanoparticles and other Paramagnetic Intermediates during High-Temperature Oxidative Pyrolysis of 1-Methylnaphthalene

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Abstract : Low Temperature Matrix Isolation - Electron Paramagnetic Resonance (LTMI-EPR) Spectroscopy was utilized to identify the species of iron oxide nanoparticles generated during the oxidative pyrolysis of 1-methylnaphthalene (1-MN). The otherwise gas-phase reactions of 1-MN were impacted by a polypropylenimine tetra-hexacontaamine dendrimer complexed with iron(III) nitrate nonahydrate diluted in air under atmospheric conditions. The EPR fine structure of Fe (III)2O3 nanoparticles clusters, characterized by g-factors of 2.00, 2.28, 3.76 and 4.37 were detected on a cold finger maintained at 77K after accumulation over a multitude of experiments. Additionally, a high valence Fe(IV) paramagnetic intermediate and superoxide anion-radicals, O2•- adsorbed on nanoparticle surfaces in the form of Fe(IV)---O2•- were detected from the quenching area of Zone 1 in the gas-phase.

Keywords : cryogenic trapping, EPFRs, dendrimer, Fe2O3 doped silica, soot
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