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Stabilizer Effects on Flow Synthesis of Iron Oxide Nanoparticles in Polyol Medium: Towards a Comprehensive Understanding of Formation Mechanisms

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Iron oxide nanoparticles (IONPs) are widely studied for their superparamagnetic properties, which make them suitable as contrast agents for MRI. While many synthetic routes have been described, one of the most popular is the thermal decomposition of organometallic compounds in polyol medium. The success of this process lies in its ability to produce IONPs with good control over their size, shape, and crystallinity. Polyols take advantage of several features such as high boiling point, reducing properties, as well as stabilizing properties enabling a control over the particle's growth during synthesis. In this work, tetraethylene glycol (TREG) was identified to be a suitable solvent for the flow synthesis of IONPs. By analogy to other conventional high temperature processes (i.e. thermal decomposition) and to modulate the particles' properties, the use of aminated and/or carboxylated oligoethyleneglycol stabilizers has been evaluated.

Starting from these experiments, a flow chemistry approach was applied to gain better control over the synthesis parameters, increase the scale-up potential and enhance safety of the process. After isolation and purification, the resulting batches were characterized by TEM, relaxometry and VSM in order to understand the influence of the stabilizers on the resulting properties and propose a particles' formation mechanism.