

### Greener Method to Control Shape and Phase of Iron Pyrite (FeS<sub>2</sub>)

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Pyrite iron disulfide (FeS<sub>2</sub>) is a very green and promising material for photovoltaic applications because of its earth abundance, and non-toxicity. A greener method was applied to synthesize pyrite with phase purity and high quality nanocrystals (NCs) by using non-toxic solvent as trioctylamine (TOA) together with octadodecylamine (ODA) and oleylamine (OLA). It was observed when increasing the ratios of ODA/TOA, the phase of iron sulfide transformed from mackinawite (FeS) through gregite (Fe<sub>3</sub>S<sub>4</sub>) to pyrite (FeS<sub>2</sub>). So, Fe<sub>3</sub>S<sub>4</sub> was considered as intermediate phase in the formation of FeS<sub>2</sub> phase in the reaction between FeS phase and excess sulfur. The small cubic and nano-dendrite iron pyrite NCs with the size of 50 nm and 20 nm, respectively, were successfully controlled by using different solvents to dissolve sulfur element. A mechanism involving the concentration of sulfur source and the aggregation are proposed to explain the shape change observed.