Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information (SI)

Elemental Anion Thermal Injection Synthesis of Nanocrystalline Marcasite Iron Dichalcogenide $FeSe_2$ and $FeTe_2$

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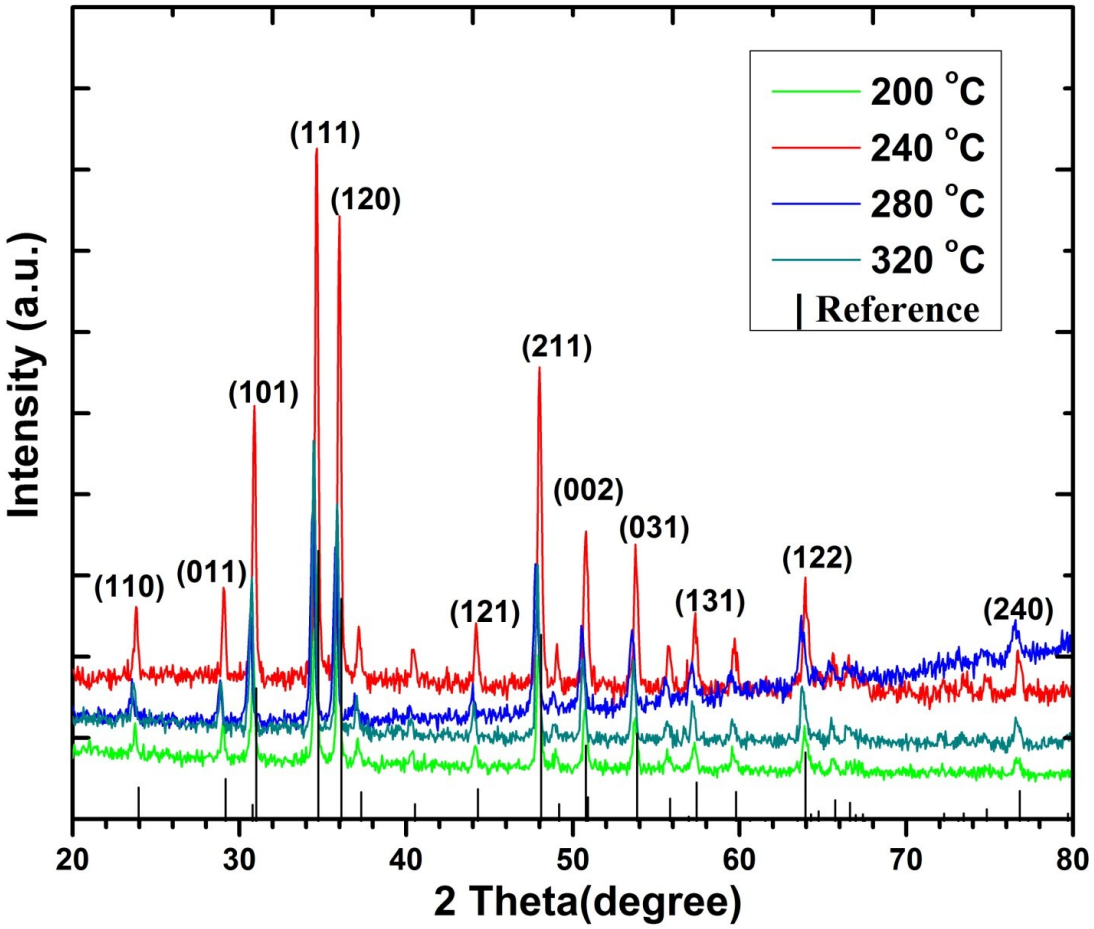
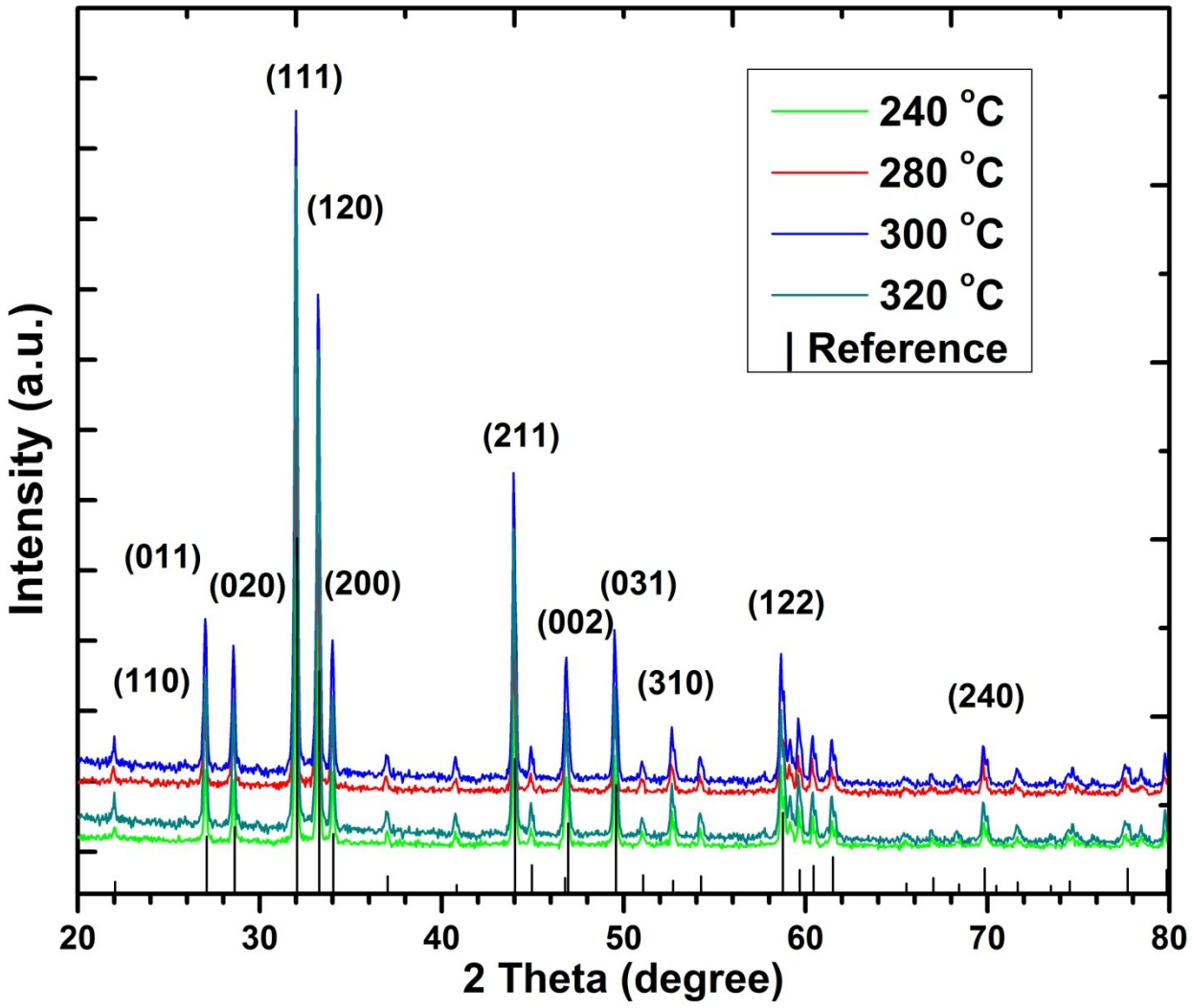
1. XRD pattern of as-synthesized nanocrystalline $FeSe_2$ as a function of reaction temperature.



SF1. XRD pattern of nanocrystalline $FeSe_2$ synthesized at different temperature. The black vertical lines represent the standard XRD pattern of orthorhombic marcasite $FeSe_2$ materials obtained from MDI JADE software PDF # 97- 004-2041. All syntheses of $FeSe_2$ NCs resulted in orthorhombic crystal structure with marcasite phase. The 280 °C trace rises with increasing 2θ due to an artifact of the measurement arising

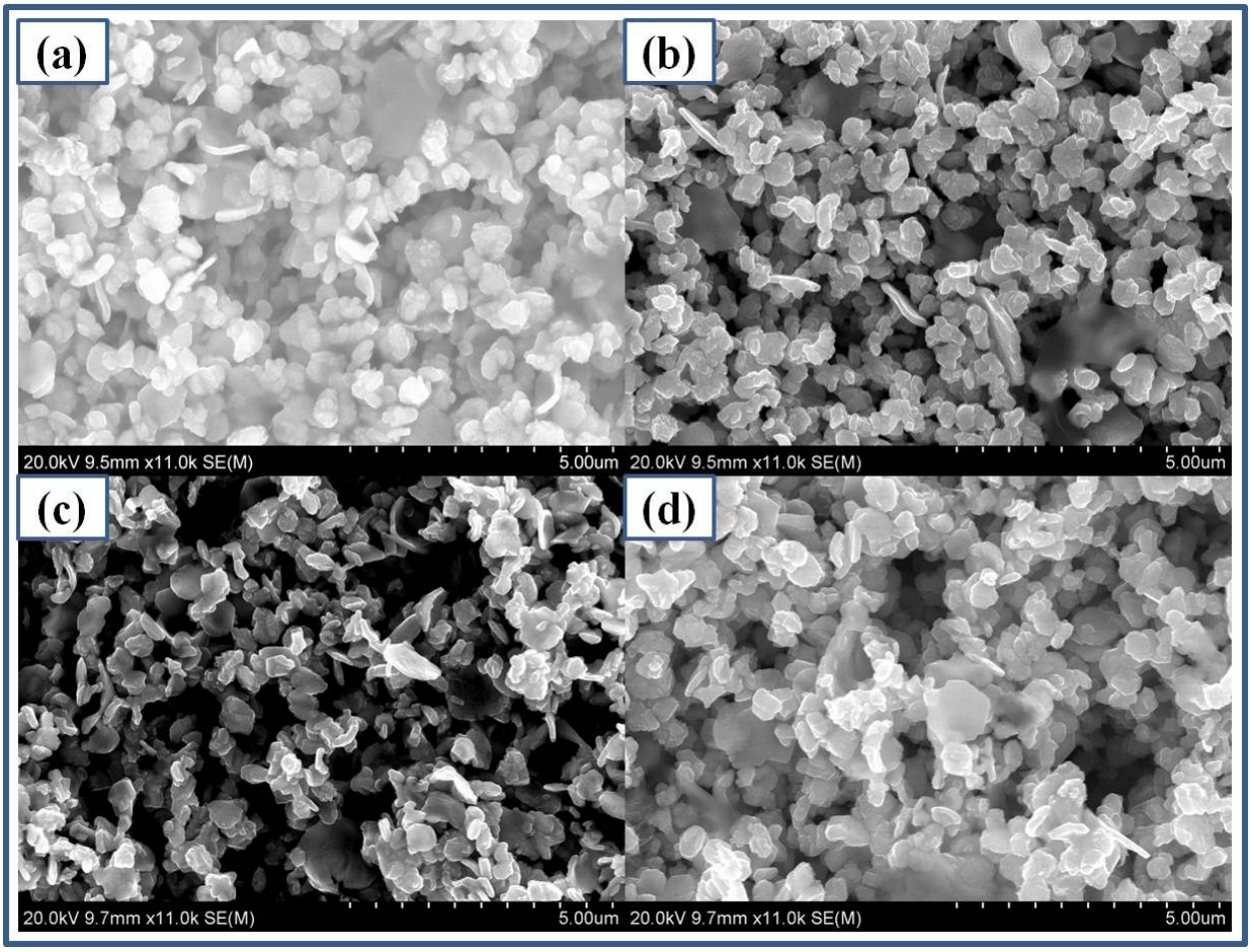
from the use of a soda lime glass substrate; all other XRD pattern were measured for samples prepared on a zero-background single-crystal silicon substrate.

2. XRD pattern of as-synthesized nanocrystalline $FeTe_2$ as a function of reaction temperature.



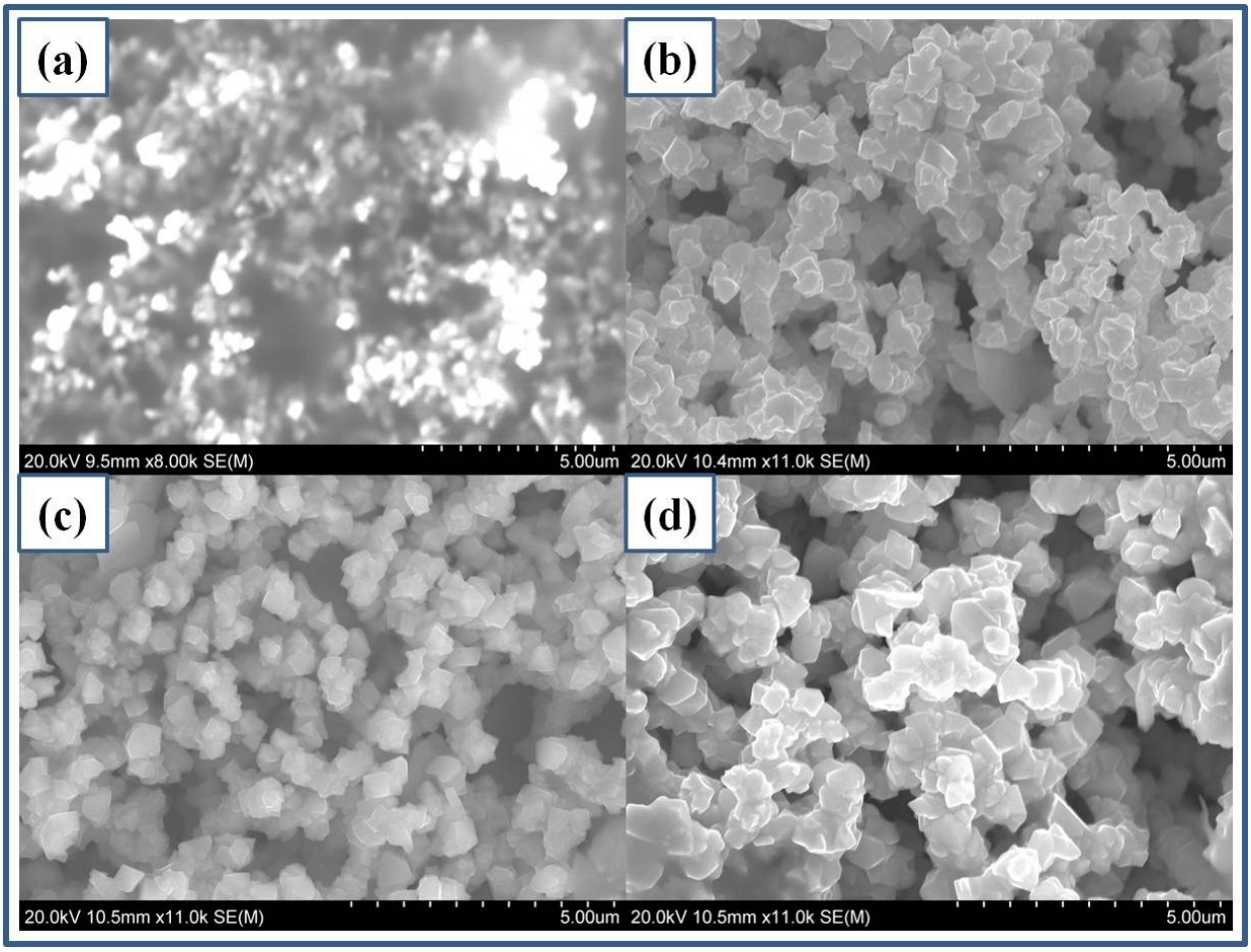
SF2. XRD pattern of nanocrystalline $FeTe_2$ synthesized at different temperatures. The reference line is the standard XRD pattern a of iron ditelluride ($FeTe_2$) (PDF # 97-063-3879) which shows excellent agreement with the XRD pattern of the synthesized $FeTe_2$ NCs. These $FeTe_2$ samples, synthesized at different temperatures, all exhibit orthorhombic crystal structure and marcasite phase.

3. Scanning electron microscopy (SEM) images of nanocrystalline $FeSe_2$ synthesized for different growth durations.



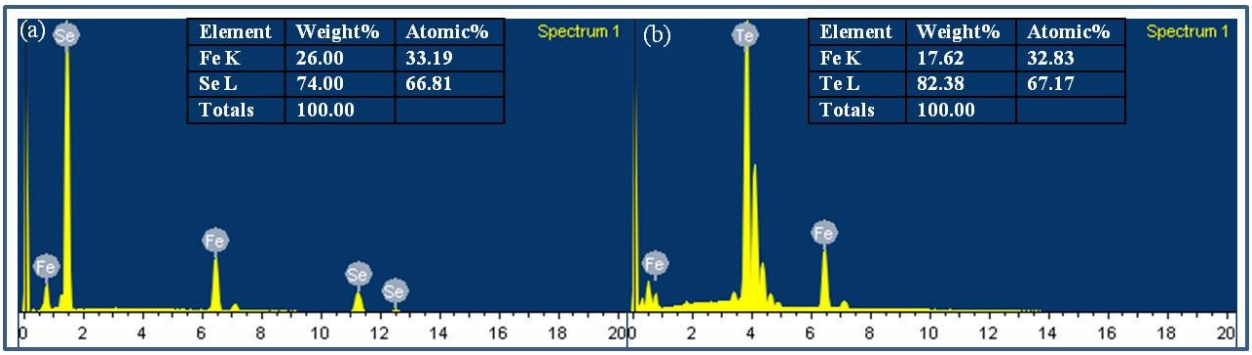
SF3. SEM Images of NC $FeSe_2$ synthesized at different growth durations after the injection of Se precursor to the reaction flask at 220 ^oC (a) 1 minute (b) 5 minutes (c) 15 minutes (d) 30 minutes. The XRD pattern of each of these NC samples confirm they are orthorhombic crystal structure in marcasite phase, and EDS analysis indicates the ratio of Fe to Se is 1.99 ± 0.03.

4. Scanning electron microscopy (SEM) images of nanocrystalline $FeTe_2$ synthesized for different growth durations.



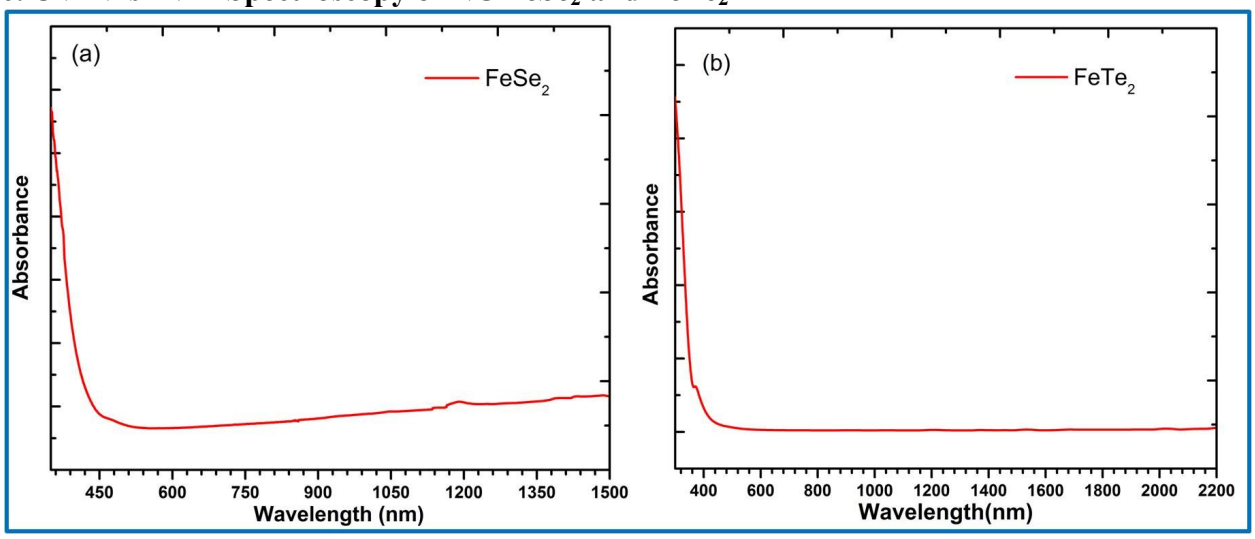
SF4. SEM Images of NC $FeTe_2$ synthesized at 300 ^oC with different growth duration after the injection of Te precursor to the reaction flask (a) 1 minute (b) 5 minutes (c) 15 minutes (d) 30 minutes. The XRD pattern of these samples, with the exception of the 1 minute growth sample, are orthorhombic marcasite crystal structure. The EDS analysis shows the ratio of Fe to Te atoms is 2.04 ± 0.02. In the case of 1 minute reaction time (a), the ratio of Fe to Te atoms is close to 1:1.

5. Energy dispersive spectroscopy (EDS) for nanocrystalline $FeSe_2$ and $FeTe_2$



SF5. EDS analysis for as-synthesized nanocrystalline (a) $FeSe_2$ and (b) $FeTe_2$

6. UV- Vis- NIR Spectroscopy of NC $FeSe_2$ and $FeTe_2$



SF6. UV- Vis- NIR Spectra of as-synthesized nanocrystalline (a) $FeSe_2$, and (b) $FeTe_2$. The samples were prepared by dispersing the NCs in the chloroform in the cuvette with optical path length 2 mm, and the optical absorption spectra were measured relative to the solvent background. These $FeSe_2$ and $FeTe_2$ NCs possess orthorhombic crystal structure, and are in marcasite phase.