Experimental

2.1. Materials

All chemicals used were of analytical grade and used as received. All utilized transition metal precursors were prepared following the standard literature procedures with slight modification.

2.2. Characterization

UV-visible study

UV-Visible spectra were recorded on a Shimadzu 1601 PC UV-visible spectrophotometer.

FT-IR study

FT-IR spectra were recorded on a Shimadzu Varian 4300 spectrometer on KBr pellets.

Elemental analysis

Elemental analyses were performed on a Heraeus Vario EL III Carlo Erba 1108 elemental analyzer.

Thermogravimetric analysis

Thermogravimetric analyses (TGA) were performed on a Perkin Elmer Pyris Diamond thermal analyzer maintaining flow rate of 20 mL/min and heating rate of 10 °C/min.

Powder X-ray diffraction study

Powder X-ray diffraction (XRD) measurements were done on a Bruker AXS D8-Advance powder X-ray diffractometer with Cu-Kα radiation (λ=1.5418Å) with a scan
speed of 2°/min at room temperature.

**Transmission electron microscopy**

Transmission electron microscopy (TEM) images were obtained on JEOL, 9JSM-100CX and JEOL, JEM2100 equipments. The sample powders were dispersed in specific solvents under sonication and TEM grids were prepared using a few drops of the dispersion followed by drying in air.

**Raman study**

Raman spectra were recorded on a RENISHAW RM1000B LRM using a 514.5 nm Ar⁺ laser excitation source.

**Photoluminescence study**

Photoluminescence (PL) spectra were recorded on a Shimadzu RF-5301 PC spectrofluorophotometer at room temperature.

**Energy dispersive X-ray study**

Energy dispersive X-ray (EDX) pattern was recorded on a JEOL, JED2300 equipment.

**Room temperature Magnetic study**

Magnetic measurement was performed on a Vibrating sample magnetometer (VSM, Lakeshore Model 7410).