

Nanoparticles of cobalt ferrite grown with controlled parameters of sol-gel method

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Introduction

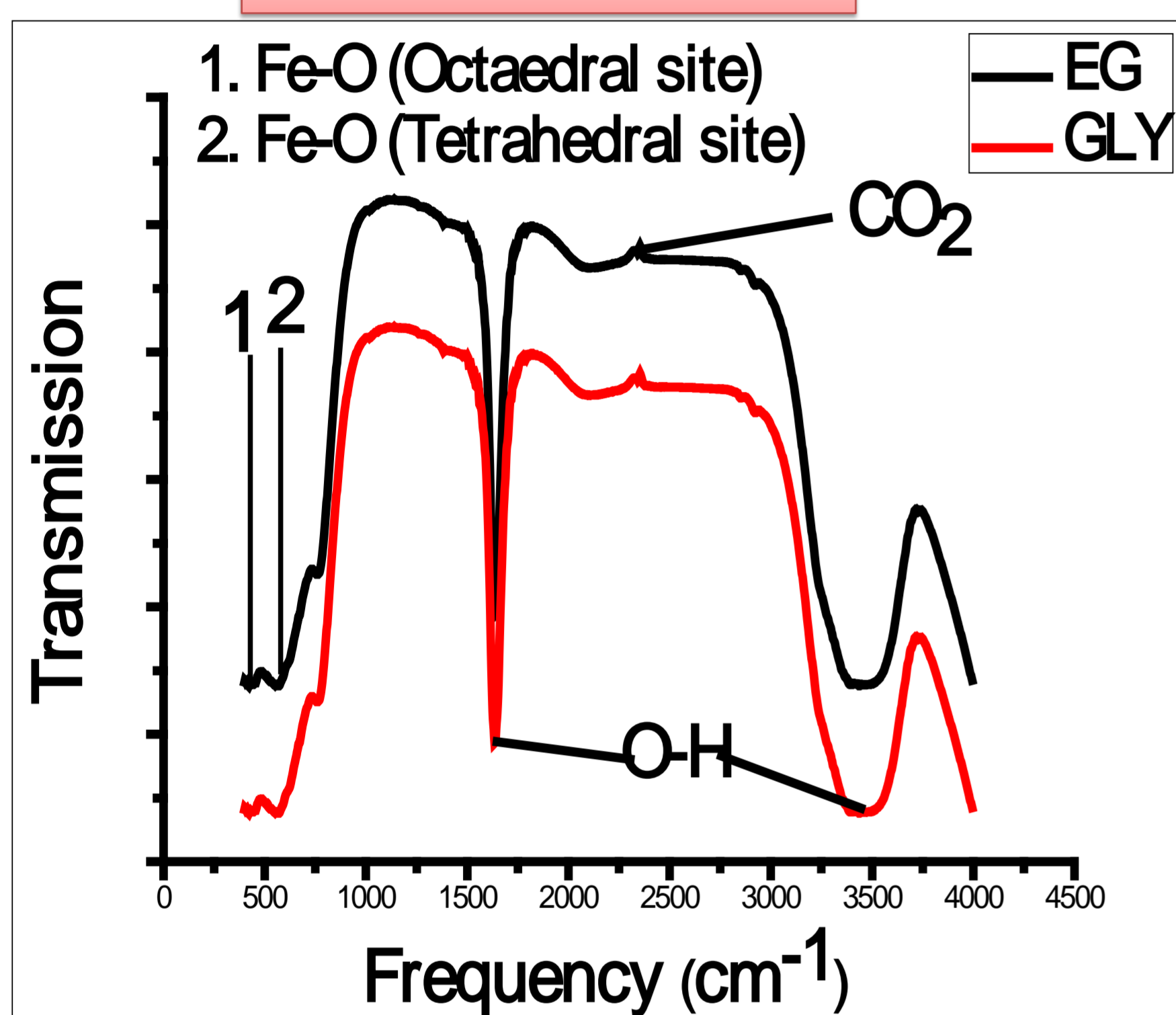
Ferrimagnetic Spinel ferrites are an important class of magnetic materials whose magnetic and electrical properties depend on the nature and distribution of their cations in the tetrahedral (A) and octahedral (B) sublattices of a cubic structure. Most of the spinel ferrites are the derivatives of the magnetite in that cobalt ferrite is a very important magnetic material which has covered a wide range of applications. Cobalt ferrite has inverse spinel structure represented by $(Co_{1-x}Fe_x)_A (Co_xFe_{2-x})_B O_4$ where x represents degree of inversion, A represents tetrahedral sites and B represents octahedral sites. Present work concentrates on preparation of cobalt ferrite nanoparticles by sol-gel combustion method and study its IR and optical properties.

Materials and methods:

Glycine (Co : Fe: Gly = 1:2:4.5)

Ethylene glycol (Co : Fe: EG = 1:2:12)

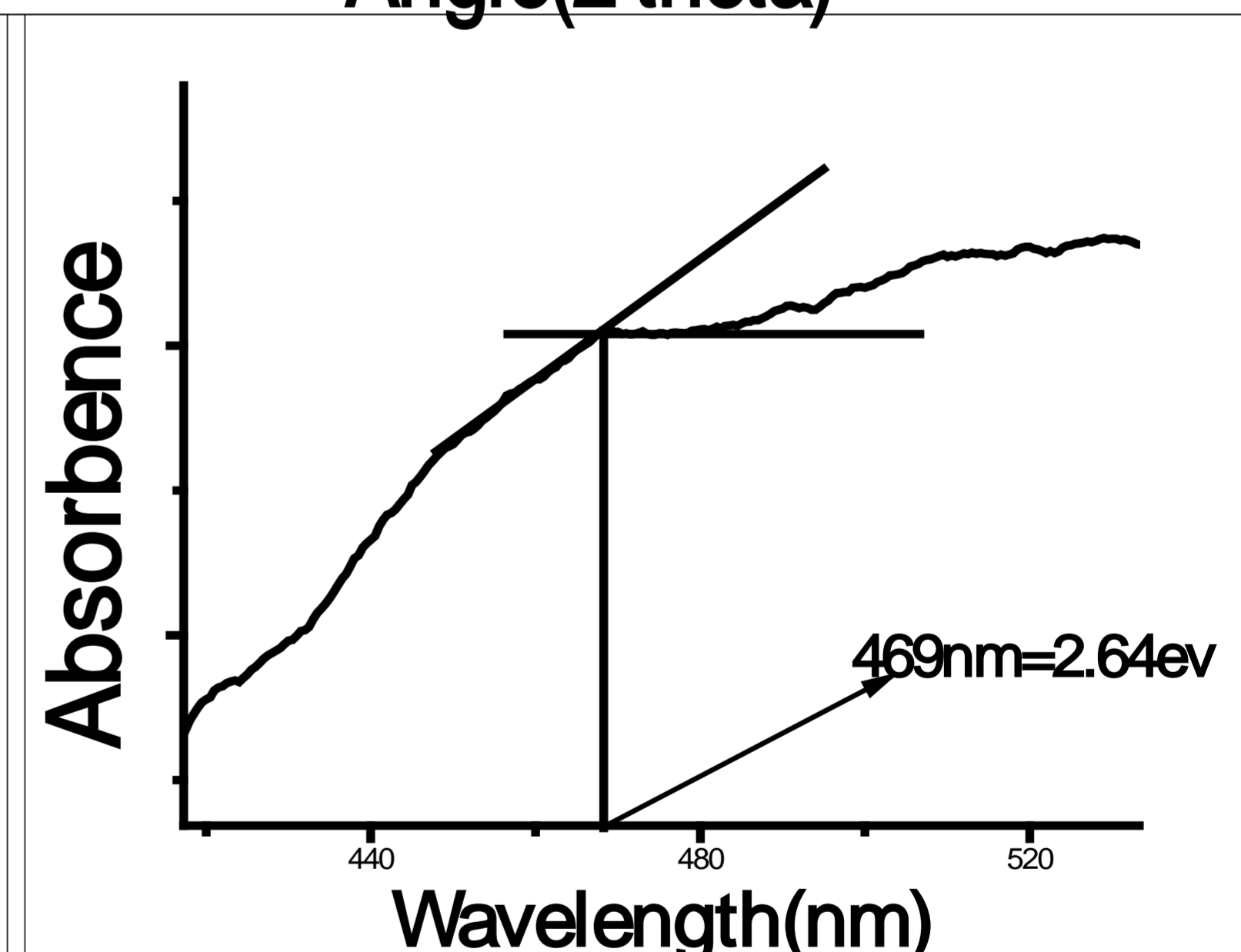
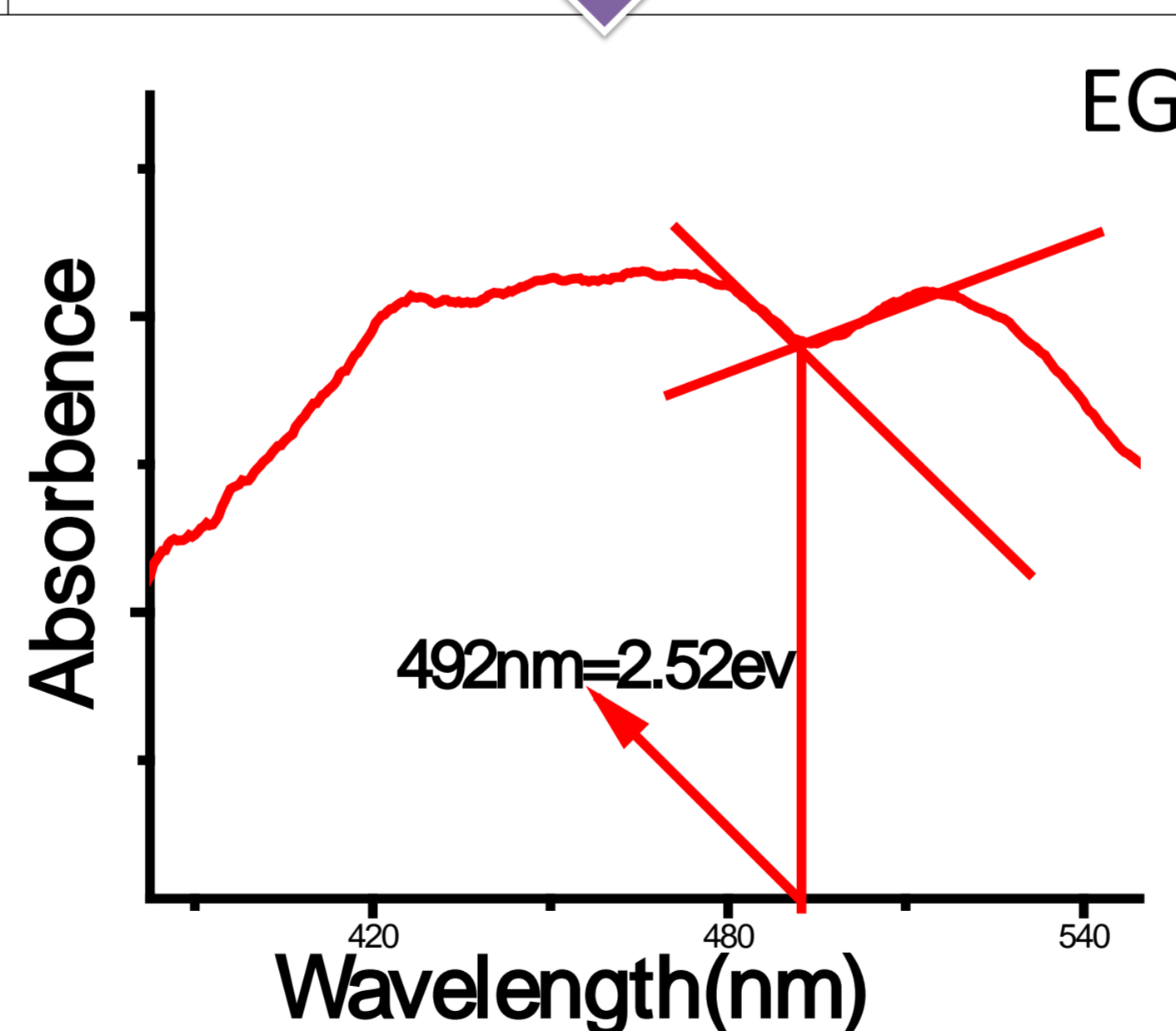
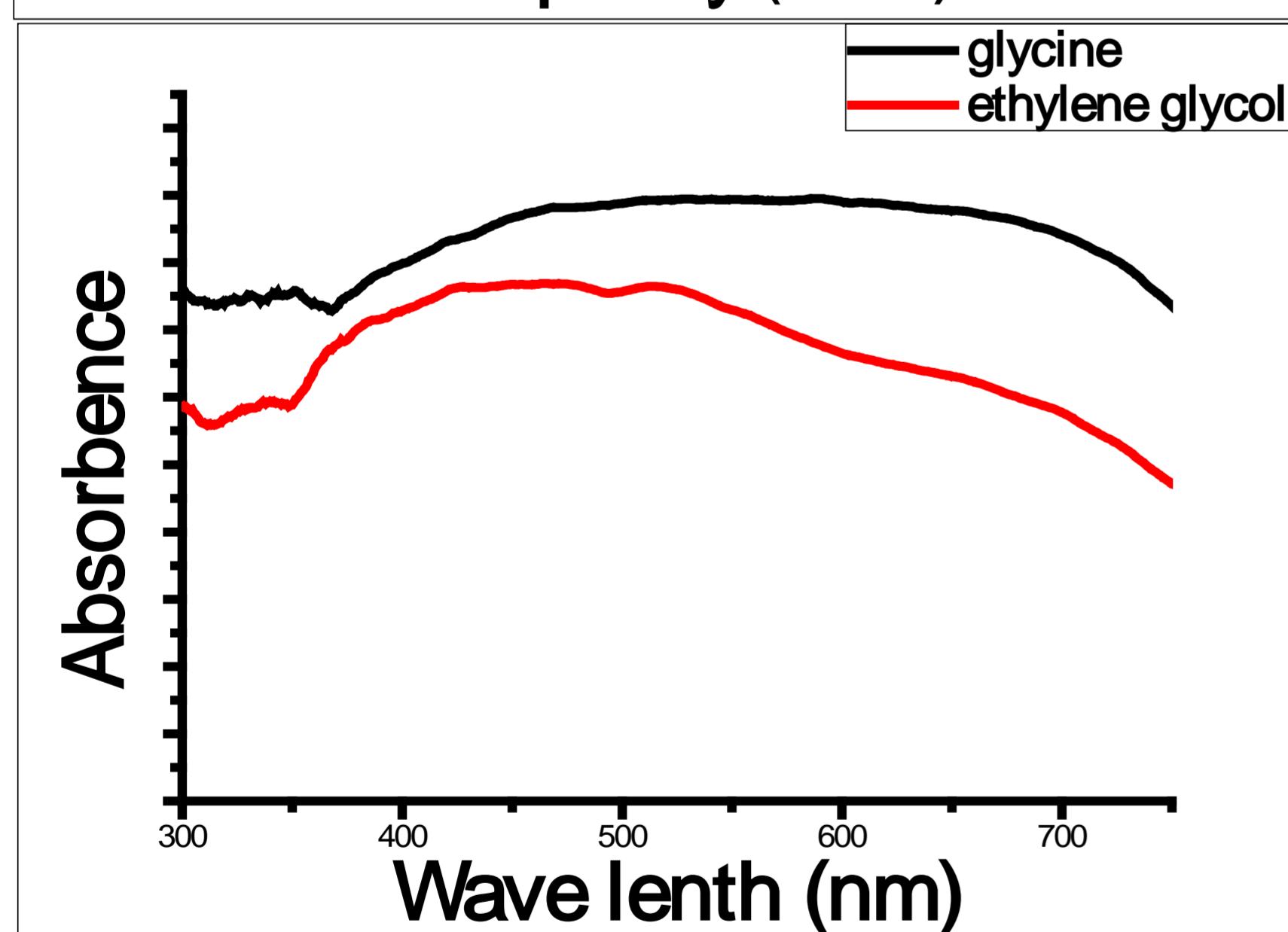
FTIR Spectroscopy



Space group is Fd3m
Lattice parameter a=8.383
Crystalline size =44 nm(EG)
=77 nm(Gly)
Lattice strain = 0.368% (EG)
=0.261% (Gly)

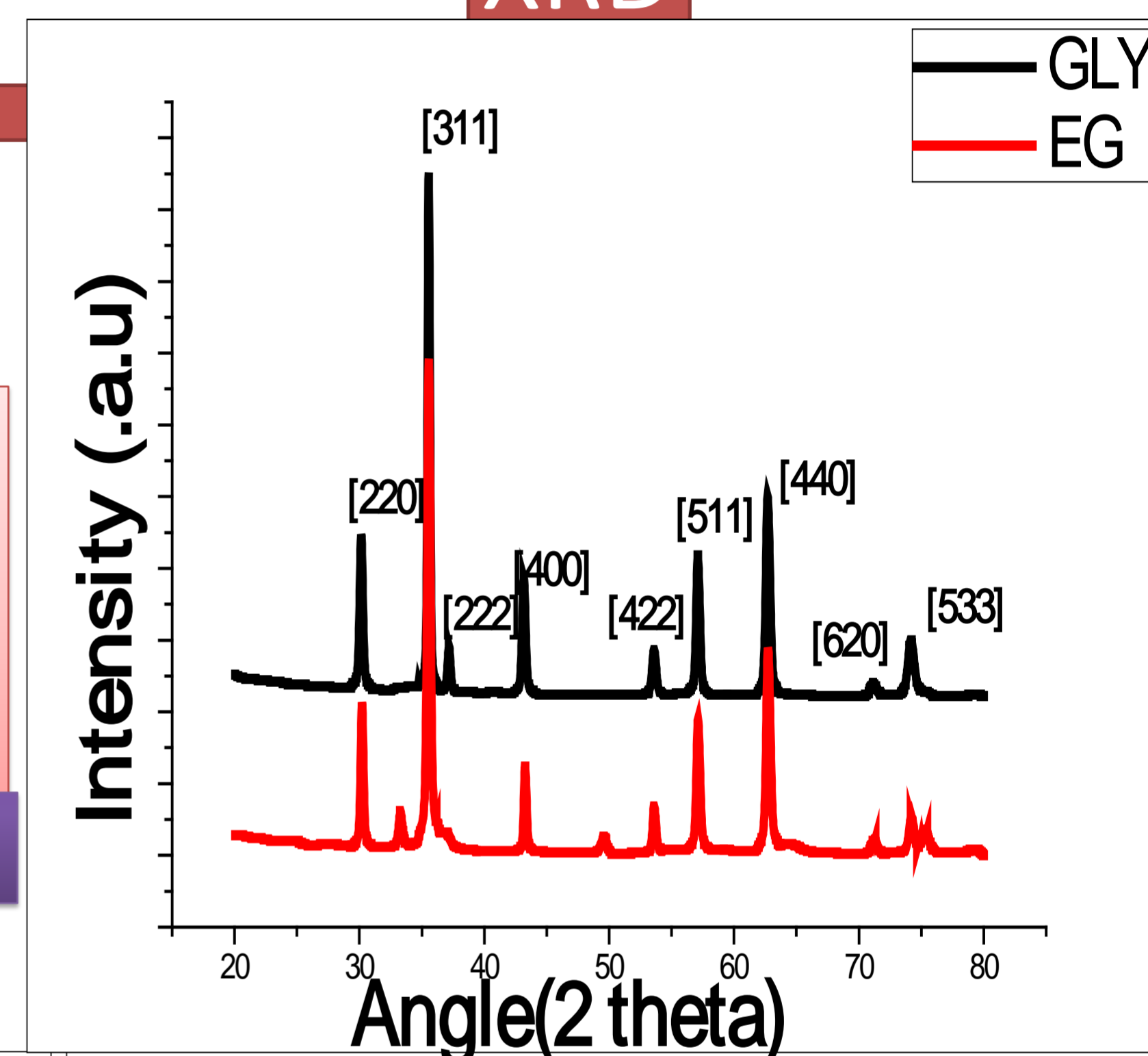
570 cm⁻¹ - Tetragonal Fe-O bond
420 cm⁻¹ - octahedral Fe-O bond
3440 and 1636 cm⁻¹- O-H bond (moisture)
2350 cm⁻¹ - co₂ (absorbed by the Sample)

UV-Vis Spectroscopy



Results and Discussion

XRD



Particles exhibited a strong band edge around 400 nm. The band gap is 2.52 eV for the cobalt ferrite prepared using ethylene glycol and 2.64 eV for the sample prepared using glycine, has been observed.

Conclusion:

By using glycine we have prepared cobalt ferrite pure phase but some impurity peaks are observed in the sample prepared using ethylene glycol. For nitrate salts glycine is better one compared to the ethylene glycol. From the FTIR it is clear that structure is spinel and samples absorb some amount of moisture. We observe difference in the band gap of the samples may be due to the impurity present in sample (ethylene glycol).