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Nickel ferrite is an important high frequency magnetic material due to its ultrahigh resistivity. Nanocrystals of NiFe<sub>2</sub>O<sub>4</sub> ferrite have been synthesized by the chemical co-precipitation of the amorphous metal hydroxides (under controlled pH values). The prepared powders have been sintered at 800 C. Room temperature X-ray measurements of the prepared samples of NiFe<sub>2</sub>O<sub>4</sub> reveal the production of single cubic phase with average crystallites size of about 30 nm, Results confirmed by transmission electron microscope (TEM) investigations. The lattice parameters, the oxygen position and the cation distribution have been determined by using Rietveld analysis. The study shows clearly surprising departure of the cation distribution from the known inverse distribution and reduce concentration of iron ions on tetrahedral sites, the degree of inversion is determined. The results of Mossbauer Effect spectroscopy (ME) and the Vibrating Sample Magnetometer (VSM) indicate the correlation between the magnetic properties and the nanocrystallinity of the investigated nickel ferrite.

Keywords: nanomagnetism, ferrites, magnetic - structure properties

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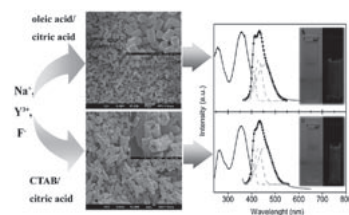
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**Synthesis and intense blue luminescence of sodium yttrium fluoride microcrystals**

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NaYF<sub>4</sub>:Eu<sup>2+</sup> microcrystals with an intense blue luminescence were fabricated. Oleic acid and cetyltrimethylammonium bromide were used as the surfactants to tune the morphology, while citric acid was taken as a ligand to stabilize the beta phase NaYF<sub>4</sub> and to reduce Eu<sup>3+</sup> to Eu<sup>2+</sup> for activation of blue luminescence. All as-prepared samples were found to crystallize in hexagonal rods or tubes. Both rods and tubes were capped with surfactants which enabled their stable dispersion in glycol to form transparent solutions. This observation seems to be the first example of the successful preparation of stable dispersion of micron luminescence solids. These transparent solutions showed an intense blue luminescent emission of Eu<sup>2+</sup> with a quantum yield of about 14 percent. Finally, the mechanism for the fabrication of the rods and tubes as well as the reduction of Eu<sup>3+</sup> ions was discussed.



Keywords: hydrothermal synthesis, inorganic luminescence, surfactants

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**Solid-state optical properties of CT complexes with ammonium anthracene-2,6-disulfonate and TCNB**

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The tuning of electronic properties by controlling the molecular arrangements in organic solid is an effective approach for both fundamental and practical research of the organic material. We have proposed that tunable solid-state optical properties of organic salts of anthracenedisulfonic(ADS) acid with aliphatic amines ascribed to arrangements of anthracene moieties. Recently we applied the tuning method to charge transfer (CT) complexes and founded that ammonium anthracene-2,6-disulfonate included 1,2,4,5-tetracyanobenzene(TCNB) to form CT complexes. Here we report several crystal structures and solid-state optical properties of the CT complexes composed of diisopropylamine, anthracene-2,6-disulfonate and TCNB. From crystallization under different conditions, we obtained three CT complex crystals, 1-3. X-ray structure analysis revealed that complex 2 and 3 have alternating stacks of 2,6ADS and TCNB molecules in which ratio are 1:1 and 1:2, respectively. On the other hand, Complex 1 has 1:1 segregated stacks. They showed very different solid-state optical properties depending on their different manners of molecular packing.

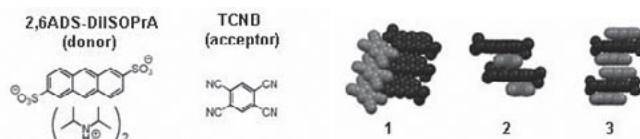


Fig.1 Molecular structure of donor and acceptor. Fig.2 crystal structure of complex 1, 2 and 3.

Keywords: charge-transfer complexes, solid-state spectroscopy, single-crystal X-ray analysis

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**Crystal and magnetic structure of quantum spin-trimer compounds Ca<sub>3</sub>Cu<sub>3-x</sub>Ni<sub>x</sub>(PO<sub>4</sub>)<sub>4</sub>**

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Ca<sub>3</sub>Cu<sub>3</sub>(PO<sub>4</sub>)<sub>4</sub> is a novel quantum spin trimer system in which the three Cu<sup>2+</sup> (S=1/2) spins are antiferromagnetically coupled giving rise to a doublet ground state (TN<1 K). By substituting a Cu<sup>2+</sup> spin in the trimer by Ni<sup>2+</sup> (S=1) a singlet ground state can eventually be realized offering for the first time the observation of the Bose-Einstein condensation (BEC) in a quantum spin trimer system. Neutron diffraction experiments with the powder samples of Ca<sub>3</sub>Cu<sub>3-x</sub>Ni<sub>x</sub>(PO<sub>4</sub>)<sub>4</sub> (x=1,2) have been carried out on HRPT and DMC instruments at SINQ to determine the arrangement of the Cu and Ni atoms in the trimers and to study possible magnetic ordering. The composition with one Ni per trimer (x=1) crystallizes in a monoclinic structure (sp. gr. P21/a, N14) with the cell parameters a=17.714 Å, b=4.885 Å, c=8.846 Å and β=123.845° at T=290K. Each trimer is formed by two crystallographic positions (2a) in the middle and (4e) at the ends of the trimer. We found that the middle position is occupied by the Cu<sup>2+</sup>, whereas the end positions are statistically equally populated with the Cu<sup>2+</sup> and Ni<sup>2+</sup>. Thus, the three different types of trimers are present: Cu-Cu-Cu, Ni-Cu-Ni and Ni-Cu-Cu.