NEW MAGNETIC COMPOUNDS BASED ON ZINC CHROMIUM SELENIDE $ZnCr_2Se_4$

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It is seeing nowadays a growing interest to an important problem dealing with the resource gap and using of alternative energy resources. That's way the question dealing with renewable energy sources is gaining popularity. Renewable energy is a numbers of ways to use the inexhaustible resources to produce electricity or other forms of energy. Solar cells based on thermoelectric generates could produce electrical energy from heat energy. Thermoelectric materials (semiconductors) which help to decide this problem play big role in chemistry of today and the future. For this purpose we need n-type and p-type material and technically more advantageous when one material allows to get both of this types.

One of the most interest compounds is zinc chromium selenide, which is a semiconductor with helical magnetic structure. It is possible to improve the electrical and magnetic properties of the materials based on $ZnCr_2Se_4$ using of some additives, for example Cu, Ni, Ho, Mn, Dy, Gd, Sn. The substitution of zinc or chromium with another metal leading to essential changes of the cation distribution and modifying physical properties of $ZnCr_2Se_4$.

In our research we concentrated on synthesis and investigation of physical and chemical properties of $ZnCr_2Se_4$ doped selected transition elements and rare-earth elements. It was studied chemical composition and structure of synthesized materials, as well as, their magnetic and electric properties. The final results showed that the presence of third cation influences electrical and magnetic properties of selenide. For example, our studies showed that substitution in the $ZnCr_2Se_4$ matrix of tin and gadolinium radically changes the magnetic properties. Magnetic and specific heat measurements showed the spin-glass-like behaviour below the freezing temperature T_f = 13÷15 K for $ZnCr_2Se_4$ doped with tin and antiferromagnetic order with the Neél temperature $T_N \sim 22$ K as well as the spin-glass behaviour of the re-entrant type with the freezing temperature T_f = 7.3 K for $ZnCr_2Se_4$ doped with gadolinium connected with the strong competition between AFM and FM exchange interactions visible in both cases by the splitting of the ZFC-FC susceptibilities.

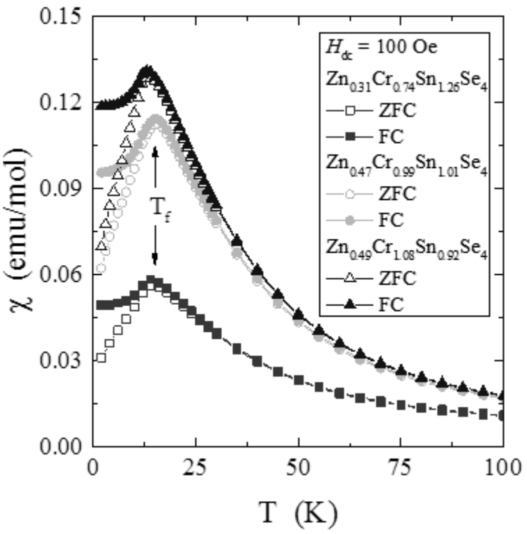

Fig. ZFC and FC dc magnetic susceptibility χ_{mol} vs. temperature T at H_{dc} = 100 Oe for the spinels under study. T_f indicated by arrow is the freezing temperature