PI: Dr. Sanjib Bhattacharya: Presently Associate Professor, UGC-HRDC, NBU

Description of CSIR funded Research Project:

Title: Study of Electrical Transport Properties of Mixed Phased Glassy Nanocomposites
Sanction No. 03(1286)/EMRII/13

Duration: 2013-2016

Total Cost: Rs. 20 Lakhs 49 Thousands and 428

Objective: To explore electrical properties of some conducting glassy nanocomposites

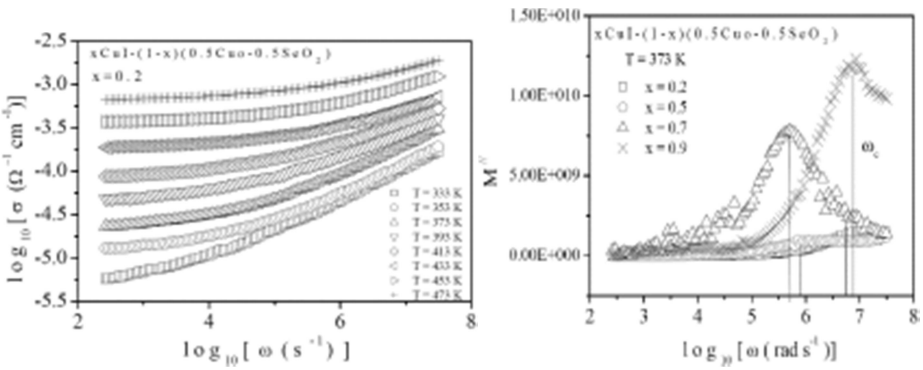
Outcomes: AgI and CuI doped selenite glass-nanocomposite system has been prepared using melt-quenching route. Their microstructure and electrical transport properties have been studied. It is observed from X-ray diffraction (XRD) study that the size of $CuSeO_3$ nanocrystallite is found to be almost same, but the variation of selenium oxide nanoparticles does not follow any trend. Fourier transform infrared spectra (FT-IR) reveal that major bands are attributed to the Se—O stretching vibration. We have investigated the electrical conductivity of these glass-nanocomposites in a wide frequency and temperature range. Dc conductivity show thermally activated anomalous nature, which may be explained from their structural point of view. Ac conductivity data have been analyzed using a power law model. It has been observed that mobile ion concentration is independent of temperature. Conductivity relaxation time has been calculated from the modulus formalism and shows thermally activated nature. The nature of variation of corresponding activation energy indicates that ionic relaxation starts for higher CuI content. A schematic model has been proposed to explain the transformation of chains into clusters in the compositions and formation of more bridging Se—O—Se bonds, which results an enhancement of ionic conductivity of the present glass-nanocomposite system.

Publication: 10 Papers in international journals

(Details are available in : https://scholar.google.co.in/citations?user=cf2NDF8AAAAJ&hl=en)

PhD produced from this project: One full time fellow, Mr Ranadip Kundu and two part time fellows, Mr. A. S. Das and Mr. A. K. Bar.

TOC:



Description of CSIR funded Research Project:

Title: Relaxation Dynamics of Lithium Ion Conducting Glass-Ceramics
Sanction No. 03(1411)/17/EMRII dated 09.05.2017

Duration: 2017-2021

Total Cost: Rs. 4 Lakhs 65 Thousand

Objective: To explore microstructure and electrical relaxation of lithium ion conductors

Outcomes: We study electrical conductivity of new Li_2O doped glassy ceramics in wide frequency and temperature regime not only for their applicability in various fields like lithium ion conductors but also for academic interest. Here, we employ "Jonscher's power law model and Almond-West formalism" to interpret mixed conduction process in the present system. We use "Mott's variable range hopping" model to analyse low temperature DC conductivity data. It also points that the ratio of power law pre-factor to the exponent ($-\log_{10}$ A/S) indicates temperature independency and strong composition dependency of present conductors. Higher lithium content in the composition may disturb "electrochemical stability" of the present system. We do believe that these glassy ceramics are suitable candidates for lithium ion battery application with lower lithium content.

Publication: 6 Papers in international journals

(Details are available in : https://scholar.google.co.in/citations?user=cf2NDF8AAAAJ&hl=en)

PhD produced from this project: Mr. A. Acharya (PhD Registered).

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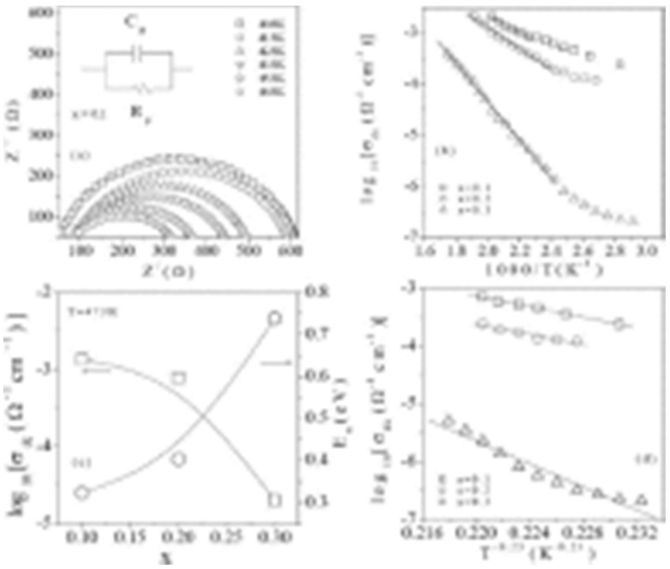

Description of DST funded Research Project:

Title: Investigationsof Electrical and Dielectric properties of chalcogenide glassy alloys
Sanction No: CRG/2018/000464 dated 11.03.2019

Duration: 2019-2022

Total Cost: Rs. 33 Lakhs 56 Thousand

Objective: To explore microstructure and dielectric relaxation of some Chalcogenide Glassy Alloys

Outcomes: In this work, the development and electrical characterization of several chalcogenide nanocomposites have been reported. X-ray diffraction (XRD) has been used to reveal their microstructures. Mott's variable range hopping model has been used to interpret the DC conductivity data of the nanocomposites at lower temperatures. The DC conductivity data at higher temperatures has been explained well using Greave's model. To explain the AC conductivity data, the Meyer–Neldel (MN) conduction rule has been employed. The AC conductivity spectra at different temperatures have been analyzed using Almond–West formalism. Different conduction models, namely, correlated barrier hopping (CBH) and modified non-overlapping small polaron tunneling (NSPT), have been used to interpret the conduction mechanism of the nanocomposites. Scaling of the AC conductivity spectra reveals that the electrical relaxation process is independent of temperature, but depends on the nanocomposite composition. The conductivity mechanism is explained using a schematic structural model.

Publication: 4 Papers in international journals

(Details are available in : https://scholar.google.co.in/citations?user=cf2NDF8AAAAJ&hl=en)

PhD produced from this project: Mr. A. Chamuah (PhD Registered).

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