Finanțat de Uniunea Europeană NextGenerationEU

Planul Național de Redresare și Reziliență

IMT Ground Floor Seminar Room and ONLINE

For „Development of novel nanocomposite materials with tunable conductivity for electromagnetic shielding and potential uses in electronics and optoelectronics applications” **Project members and whoever else wishes to attend**

Seminary in the framework of the project PNRR/2022/C9/MCID/I8 CF 23/14.11.2022

”Progress on modelling the *rf* dielectric spectra of rare earths and graphene doped ZnO nanocomposites”

Wednesday 28th of February 2024

13:30-14:30

Dr. Titus Sandu, member of the project

Link for ONLINE attendance:

https://meet.google.com/gix-cwdy-xge?hs=224

Presentation summary

ZnO and compounds based on ZnO present a great interest for their potential applications in technological applications. The list of advantages is large, but we enumerate a few: low cost and easy to fabricate, direct bandgap with high quantum efficiency, photochemical activity, wide bandgap with use in transparent electronics, etc. On the down side we mention the challenge in ambipolar doping: the n-doping is straightforward, but the p-doping presents many hurdles.

Doping of ZnO with rare earth elements: Er, La, and Sm effects were studied. To further increase their conductivity, graphene (G) (vol. 1%) was added to the doped ZnO materials to form RE-G:ZnO homogeneous nanocomposites. Electrical properties were assessed by measuring the complex dielectric constant from 1 Hz to 1 MHz frequency range and from -150º C to 200º C temperature interval.

To interpret the data, a microscopic model that associates dielectric spectra to an equivalent circuit was developed. The elements of the equivalent circuit were further related to electric properties of doped ZnO and graphene. The analysis revealed an increased *dc* conductivity of ZnO matrix with doping due to deep level impurity states induced by Er, La and Sm. On the other hand, the graphene nanofiller shows both metallic (below 0º) and semiconducting conductivity (above 0º). Finally, in the *ac* regime, the conduction is assured by quantum tunneling in the undoped ZnO and polaron assisted in doped ZnO.

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