Eutectic Materials for 5G and 6G Technology

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The growing interest in creating an internet-based network of different devices demands faster and more efficient communication. Such communication needs to work at GHz and THz ranges. Therefore, they trigger research areas for fabricating optimized dielectric materials which are the backbone of wireless communication [1]. Materials with minimum dielectric loss, high-quality factor and high thermal stability are highly desired. Recently eutectic materials start to bring lots of attention as materials for different applications including energy [2], metamaterials [3], plasmonics [4] and others [5]. In this work we aimed at investigating the potential of eutectic materials for the 5G and 6G Technology, while including component phases optimal for these applications. TiO_2 is one the well-known dielectric materials due to its high permittivity and low loss. Additionally, combination of TiO_2 with other oxides such as MgO and Al_2O_3 has been shown to improve the thermal stability and loss.

In this project, we utilize the micro-pulling-down solidification technique to control crystalline phases and interfaces in order to reduce the dielectric loss. TiO_2 and MgO have been selected as precursors and the composition percentages are selected based on two eutectic points in the phase diagram. The growth has been done at different pulling rates. A set of measurements have been conducted after the crystal growth, to study structural and dielectric properties. XRD measurements show the formation of TiO_2 and $MgTi_2O_5$ phases. Dielectric permittivity measurements in GHz range of the eutectic composites obtained with different pulling rates will be presented.

The authors thank the ENSEMBLE[3] Project (MAB/2020/14) which is carried out within the International Research Agendas Programme (IRAP) of the Foundation for Polish Science co-financed by the European Union under the European Regional Development Fund and the Teaming Horizon 2020 programme of the European Commission.

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