Thermal, Electrical, and Electromagnetic Shielding Properties of Terpolymer of Tetrafluoroethylene, Hexafluoropropylene and Vinylidene Fluoride (THV)/Graphene Nanoplatelets (GNP) Nanocomposites

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In an era of advanced electronics, issues like adequate electromagnetic interference protection and effective heat dissipation are crucial due to the malfunctioning that they may cause. The high density of electronic elements forced by the miniaturization trend intensifies problems, and a solution is urgently needed.
Polymer nanocomposites are materials able to combine multiple features in one and may be treated as alternatives to currently existing solutions in providing electromagnetic compatibility (EMC) or effective heat dissipation. Therefore, comprehensive studies of electrical, thermal and electromagnetic shielding properties of THV/GNP Nanocomposites are presented here.
Unlike standard production methods, the simple powder mixing and hot pressing technique are proposed as a valuable, cheap alternative, guaranteeing sufficient sample homogenization.
The following results have been achieved: thermal conductivity, κ = 1.65 W/mK, which gives 820% enhancement compared with pure THV matrix, EMI shielding effectiveness, SE_{TOT} = 23 dB at 5 GHz, with absorption as the primary shielding mechanism, and electrical conductivity σ = 1.49 S/cm. Interestingly, the saturation effect is observed for EMI shielding effectiveness and electrical conductivity of 10 wt% GNP loading.
The finding presented here is the first step in developing multifunctional material with outstanding EMC protection features and thermal properties that may be applied in airborne and space.

Figures

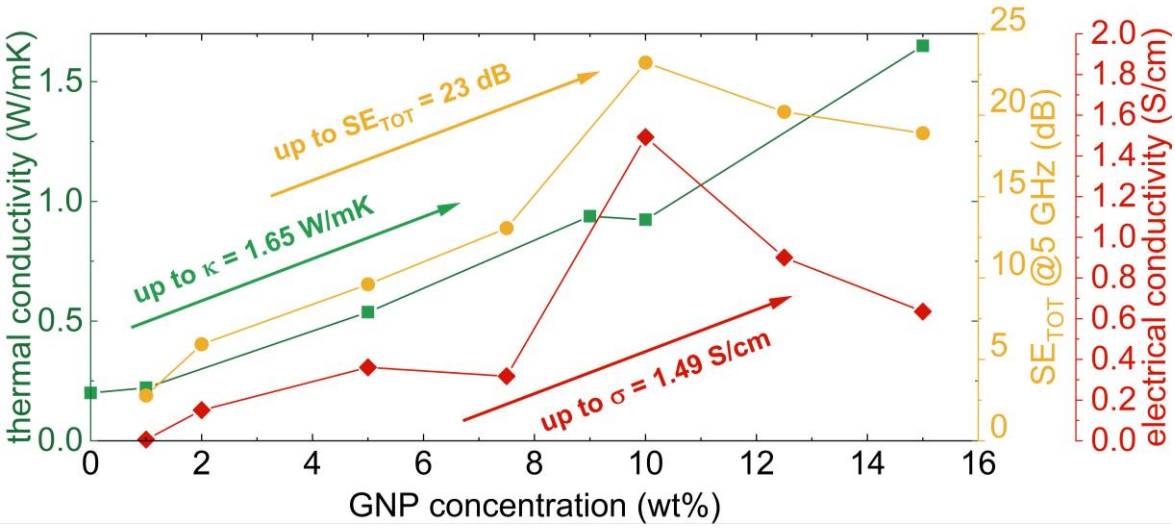

Figure 1: Thermal conductivty, EMI effectiveness, and electrical conductivty of THV/GNP nanocomposites.