IOCM 2025 Conference

The 4th International Online Conference on Materials

3–6 November 2025 | Online

MDPI

BariumTitanate/Polyvinylidene-fluoride Nanocomposites for Advanced Energy Applications

Matanat Babayeva 1, Narmin Ahmadova 2

Physics Faculty, Chemical Physics of Nanomaterials, Baku State University, Academic Zahid Khalilov 33, Baku, Az1148, Azerbaijan

matanatbabayeva5@gmail.com , agmedova07@gmail.com

INTRODUCTION & AIM

PROBLEM

Next-generation technologies (e.g, smart grids, portable electronics) instantly need energy storage devices with remarkably higher energy de nsity.

LIMITATION

Conventional materials faces with problems such as low-lifespan and insufficient efficiency.

SOLUTION

Nanocomposites with high dielectric permittivity and energy density can overcome those limitations to ensure sustainable dev elopment

AIM OF THE WORK: This review carefully investigate the works to determine how BT nanoparticle incorporation [1] and thermal treatment [2] affect the dielectric properties and energy storage density of BT/PVDF nanocomposites.

METHOD

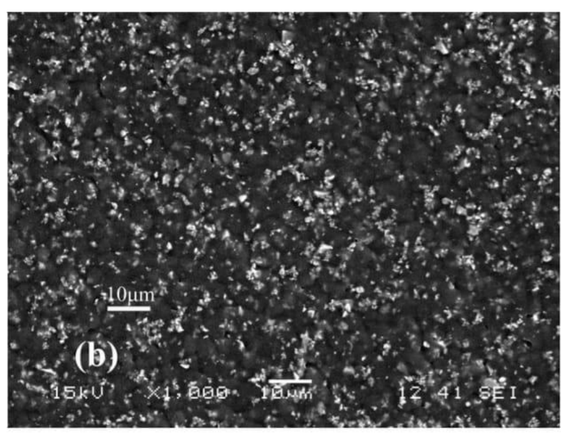
This work is based on a extensive analyzes of previous studies on Barium Titanate/ Polyvinylidene-fluoride Nanocomposites. The focus was on discussing different synthesis techniques, structural evaluation and enhancing dielectric performance. As a result, we concluded that BT/PVDF can be successfully fabricated using effective methods such as solvent-casting, electrospinning, and spin-coating. The review studies emphasized that characterization methods like X-ray Diffraction, SEM, and FTIR are generally utilized for defining structural, morphological and functional properties.

Table: Techniques Used for Fabrication of BT/PVDFN Nanocomposites

a)

SYNTHESIS TECHNIQUES
SOLUTION CASTING
ELECTROSPINNING
SPIN-COATING

b)



The SEM image of the surface of the film sample with BT concentration of 10 vol. % (Source: Adapted from Ref. [1], Ke Yu et al., 2013).

RESULTS & DISCUSSION

The review studies clearly demonstrate that BT/PVDF nanocomposites exhibit exceptional dielectric and energy storage performance compared to pure PVDF. It has been demonstrated that incorporation of BT nanoparticles into polymer matrix significantly enhance the polarization and power density because of increased interfacial areas [1]. Thus, increasing the volume fraction of BT in the PVDF (Figure 1) result in optimal performance of energy storage devices.

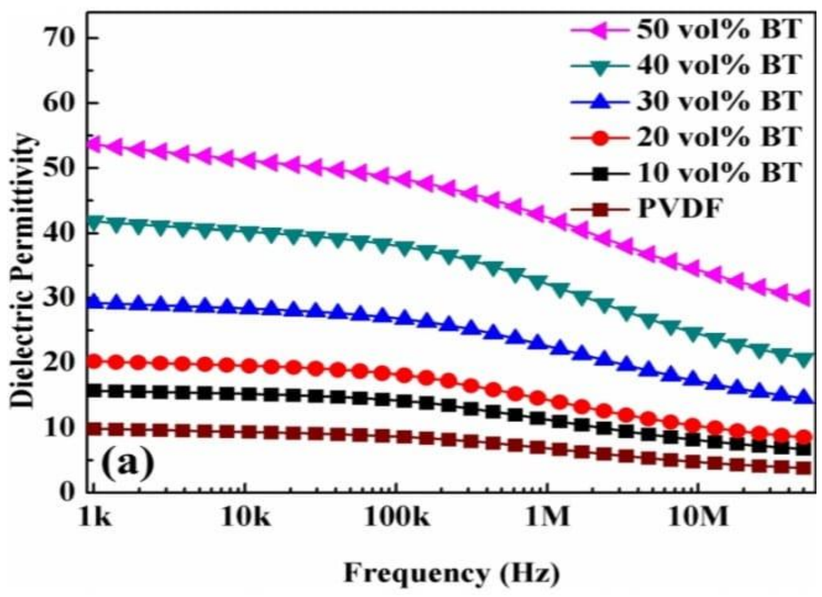


Figure 1. The frequency dependencies of the dielectric permittivity measured at room temperature from 103 to 5 107 Hz. (Source: Adapted from Ref. [1], Ke Yu et al., 2013).

On the other hand, it has been shown that the thermal treatment advances the dielectric properties by enhancing compatibility of BT and PVDF and also result in the limitations of movements of molecular chains of PVDF and BT nanoparticles [2].

INCREASING TEMPERATURE

INCREASING DIELECTRIC CONSTANT

CONCLUSION

Barium Titanate/Polyvinylidene-fluoride (BT/PVDF) nanocomposites are accepted as future promising materials for next-generation energy storage devices because of high dielectric permittivity and energy density that can be enhanced with different ways including thermal treatment and incorporating BT nanoparticles.

REFERENCES

[1]. Ke Yu, Hong Wang, Yongcun Zhou, Yuanyuan Bai, and Yujuan Niu J. Appl. Phys. 113, 034105 (2013), http://dx.doi.org/10.1063/1.4776740

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