WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Comparative Study of Thermal Conductivity of CNT Based Fly Ash Waste Composite and Study Its Mechanical Property-Review

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ABSTRACT

In the proposed work, carbon nanotubes (CNT) reinforced industrial waste fly ash -based polymer nanocomposites were fabricated. Strong interfacial bonding between CNT-fly ash and epoxy will confirmed by SEM technique. Low water absorption of about 0.17 % was observed from 20 vol % CNT reinforced nanocomposite sample. However, the water absorption slightly increases with the increase of CNT contents in fly ash-based nanocomposites due to hydrophilic and polar characteristics of CNT. Flexural strength of nanocomposites increases with increase of CNT amount. The enhancement in flexural strength is attributed to the high dispersion of the CNT in epoxy polymer and weakening of Vander Walls forces. Thermal conductivity is depending on percentage of CNT reinforced with fly ash polymer matrix. Normally thermal conductivity increased with increased CNT percentage in fly ash polymer composite. Such behaviour was attributed to the conducting nature of CNT and creation of space charge distribution in polymer matrix.

Introduction

Carbon nanomaterials consisting of graphene, unmarried and multiwall carbon nanotubes (CNTs) and graphite had been these days verified wonderful substances as they show off excessive mechanical and electric homes. CNTs have these days been used as reinforcement factors in insulating polymer wherein it bureaucracy electrically conductive networks because of their exact electric conductivity [1-3]. Specially, CNTs have an extended and skinny cylinder of carbon with very excessive issue ratio that are being taken into consideration as a capacity reinforcement detail in polymer composites due to the fact they show off wonderful mechanical (tensile electricity and modulus), electric, chemical, and thermal homes in comparison to the conventional fibers and different factors [4-10]. These precise homes of carbon nanomaterials loaded polymer composites have proven exquisite capacity for packages in aerospace, automotive, engineered composites, self-restoration composites, hearthplace-retardant composites, electricity storage, biotechnology and subsequent era electronics engineering and pharmaceutical domain [11-17].

In addition, looking sustainable usage of the coal burned with the aid of using-merchandise consisting of fly ash, are exceedingly needed. Usually, fly ash is the captured with the aid of using electrostatic precipitators and/or with appropriate particle filtration gadget previous to attain of flue gases in chimneys [18-21]. Depending upon the places of mining reassets and the composition of the coals, the additives of fly ash appreciably varies.

Usually, nearly all version of fly ash have excessive quantities of silicon dioxide (SiO2), calcium oxide (CaO), aluminum oxide (Al2O3), and iron oxide (Fe2O3) [22-25]. Although severa techniques had been hired to make use of the fly ash as diverse constructing substances software consisting of fly ash bricks, fly ash-primarily based totally cement/avenue creation and polymer composites, however nonetheless approximately forty million heaps of fly ash had been now no longer applied for any purposes.

The fallacious disposal of fly ash and their alkaline nature and non- biodegradability creates exceptional sort of disorder in human along with anemia, lung and pores and skin most cancers and dermatitis [26, 27]. Moreover, fly ash primarily based totally geopolymer composite are currently taken into consideration as a substitute for normal Portland cement because of their price efficiency, low shrinkage/thickness swelling, speedy electricity benefit rate, chemical balance and their corrosion resistance nature[28-30].

However, geopolymers have a tendency to be come to be extra brittle than OPC due to the fact its cross-connected shape and it's far non-desirables for structural packages specially for safety-primarily based totally structural design. Therefore, looking geopolymer loose polymer composite loaded with fly ash filler are in excessive demand.

Recently, exceptional herbal fibers and macro-fibers consisting of cotton, polyvinyl chloride, steel, polypropylene are used to music the mechanical homes of the polymer`s composites for multifunctional packages [31-33]. Moreover, because of wonderful and advanced homes of CNT over different fibers, it became these days utilized in polymer composites and cements industries to enhance the hydration, mechanical, porosity homes and to manipulate the electrical assets withinside the nanocomposites.

Recently, CNT became correctly utilsed as filler to enhance the mechanical homes and electric homes of epoxy composites [34-36]. To apprehend the impact of issue ratio, extent fraction and length of CNT at the mechanical assets consisting of tensile electricity of polymer composites, diverse theoretical fashions consisting of Ouali and Lyngaae-Jorgensen (L-J) have been these days stated with the aid of using K. Y. Rhee and his team [35-36]. Based on Ouali method and Takayanagi version it became additionally stated that mechanical electricity of polymer/carbon nanotubes nanocomposites may be progressed with the aid of using CNT reinforcement [36-37].

Zare et al have stated that community formation, interphase areas and dispersion of CNT and their surrounding interphases exceedingly have an effect on mechanical assets of nanocomposites [37]. Moreover, the percolation threshold and electric conductivity of CNT stuffed polymer nanocomposites are strongly depending on the length, dispersion best of CNT, touch diameter, interphase thickness and electron tunneling [39-40]. Recently, biodegradable poly (lactic acid) (PLA)/poly (ethylene oxide) (PEO)/carbon nanotubes (CNT) nanocomposites became additionally stated and it became confirmed that the addition of nanoparticles to the nanocomposites will increase the primary everyday strain variations and it additionally more desirable the pliability of nanocomposites because of the mechanical interactions among polymer chains and nanoparticles [41-47]. Recently, W. Allafi et al have stated the impact of CNT at the tensile electricity of fly ash thermoplastic composite [48]. Moreover, synthesis of CNTs on fly ash debris for growing the carbon nanotubes/fly ash composites with the aid of using CVD approach is likewise stated with the aid of using the L. Fangxian and his team [49]. U. Devadiga et al. have stated the CNT and fly ash bolstered Al nanocomposites synthesized with the aid of using powder metallurgy course and that they stated the hardness take a look at of the fly ash-CNT composites [50]. However, dispersion of carbon nanostructures in polymer composites continues to be one of the primary demanding situations because of van der Waals forces which reason the bundling and agglomeration that limition their capacity benefits for actual packages. Therefore, improving the mechanical homes of CNT bolstered polymer composites via right dispersion of CNT could be very hard. However, to the first-class of our knowledge, the impact of CNT and their filler awareness on flexural and dielectric homes of in fly ash-primarily based totally nanocomposites via compressive molding course below thermoset polymer aren't but stated. Moreover, tuning water absorption, mechanical, dielectric and electric homes of nanocomposites with the aid of using reinforcement of dispersed CNTs in conjunction with business waste particulates are very hard and exceedingly acceptable for his or her flexible packages. These nanocomposites have capacity superior packages in severa sectors along with wise constructing and hearthplace resistant composites, clever nanoelectronics, vehicle frame parts, packaging fields, strain-sensing, electromagnetic Interference (EMI) protective and as bullet evidence composite substances [51-55].

Previous Work:

In the field of thermal conductivity so many works done but carbon Nano tube reinforced fly ash composite thermal conductivity is not reported.

Proposed Work:

Carbon Nano tube possess more attractive electrical and mechanical property so we proposed to comparative study of thermal conductivity of CNT reinforced fly ash composite. and also try to prepare fly ash CNT based composite and its various application in the field of energy harvesting, preparing automobile body parts ,aircraft body parts, small electronic instruments etc.

Proposed work flow chart:

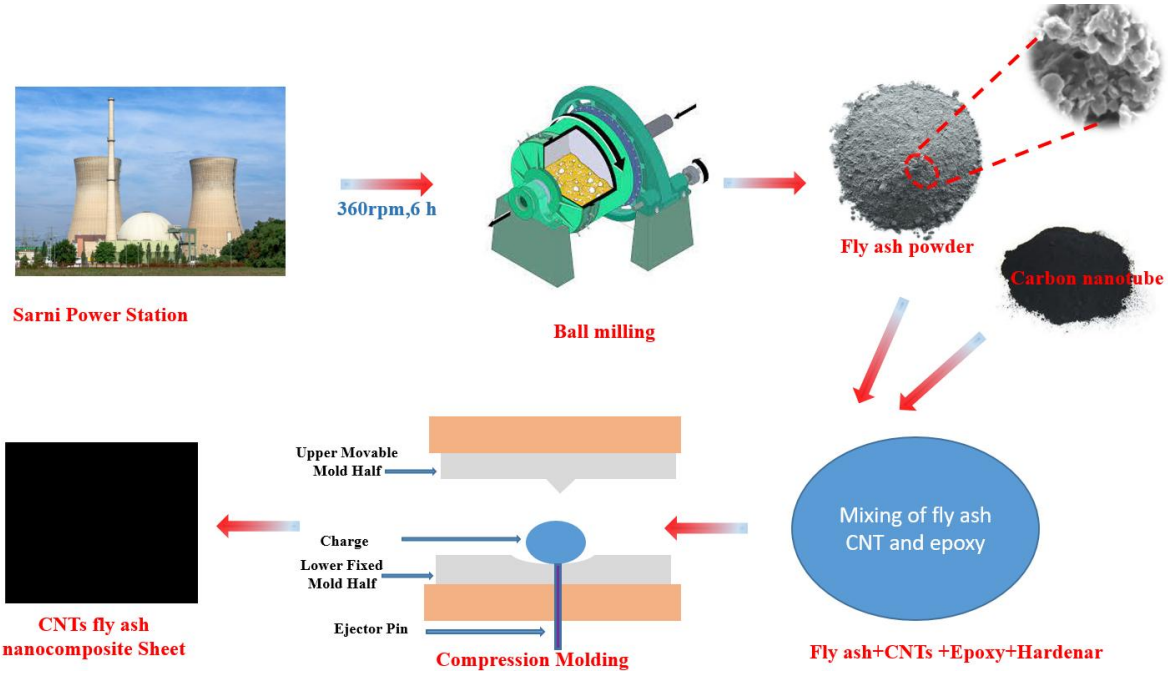

Fig:1 Flow chart of our proposed work

Conclusion:

In summary, so many research papers reading after that carbon nanotubes reinforced fly ash polymer nanocomposites are fabricated under compressive molding method at low temperature. Morphological and structural properties of CNT filled nanocomposites proposed to investigated. Fly ash and CNT were dispersed in polar DMF solvent and the solution was ball milled before preparing the nanocomposites. Effect of CNT on water absorption, flexural strength and dielectric properties proposed to analysed with variation of CNT contents in epoxy polymer. We proposed to flexural strength of the fly ash polymer nanocomposites was improved by CNT reinforcement. The enhancement in the flexural strength in the fly ash nanocomposites was discussed in the light of good dispersion of the CNT tubes in the epoxy polymer/DMF, weakening of Vander Walls forces and crystallization effect induced by CNTs.Thermal conductivity proposed to achieve increased with carbon Nano tube percentage increased.

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