Publications Template

#	Research Title	Field	Abstract	Year of Publication Publishing	Publishing Link "URL"
1	Total Ionizing Dose Effects on Commercial ARM Microcontroller for Low Earth Orbit Satellite Subsystems	Space radiation and materials	Despite the harshness of the space radiation on satellite electronic components, some Commercial Of The Shelf (COTS) can sustain such harsh environment. Thus, the low-cost advantage of the COTS can be utilized given that these electronic components meet the technical design requirements of the targeted satellite subsystem. Because of the complexity of microcontrollers and their various integrated functionality, they present a hardness assurance challenge. A careful technique was followed in analyzing the space radiation effects. Then rigorous tests should be conducted to test the performance of the candidate microcontrollers under these effects. This paper presents the predicted dose depth curve and the total ionizing does test results for a commercial ARM microcontroller for Low Earth Orbit (LEO) satellites. Such test results help estimate the effect of space environment on the microcontroller and decide if such microcontroller is an accepted candidate for LEO missions or not.	April, 2017	https://asat.journals.ekb.eg/article_22762_fab1b7e5cac17b8351b044472e9f5a40.pdf
2	Thermo-physical and Mechanical Characterization of Epoxy/MWCNTs'	Space materials and qualification	In this study, we add MWCNTs to enhance the properties of the epoxy as a resin matrix for a nanocomposite material. Thermal properties are enhanced by improving the matrix properties. An investigation was performed to find the relation between the thermos-physical properties and the MWCNTs percentage in epoxy matrix. A various weight percentage of MWCNTs was dispersed in epoxy matrix to be examined these were (0.1, 0.25, 0.5, 1.0) %. The samples were prepared with the sonication technique for about an hour and cured in an open mold in autoclave at 80°C for about four hours and made into (6x6) mm square with (1.0) mm thickness. The thermal conductivity (k)	December-2019	https://www.ijser.org/researchpaper/Thermo-physical-and-Mechanical-Characterization-of-Epoxy-MWCNTs-Nanocomposites.pdf

	Nanocomposites		was obtained by measuring the thermal diffusivity (α) and thermal effusivity (e) using the photoacoustic (PA) technique. The composites exhibit about (180) % improvement in k at (1.0) wt. %. Micromechanical models were evaluated to predict through-thickness thermal conductivity of the manufactured sample, and then compared with the experimental results. A Finite Element Model (FEM) was developed to reveal heat transport mechanisms of the resultant nanocomposites. The nanocomposite design for finite element analysis (FEA) provided close predictions and performed better than the micromechanical models		
3	A Comparative Study of the Effect of MWCNT and Al_2O_3 Nanoparticles on the Epoxy/Carbon Fiber Composite Space Structure	Composite materials and characterization	The fabrication of epoxy-based nanocomposite with either multi-wall carbon nanotubes (MWCNT) or Alumina nanoparticles (ALNP) as additives were managed. To ensure a decent dispersion of additives in the epoxy resin, a magnetic stirrer and a high-energy sonicator were operated with temperature control. Different additives fractions of 0.5 wt.% and 1 wt.% were used for MWCNTs and ALNP, respectively. The nanocomposites were tested by a Universal Testing System (UTS) to determine the mechanical properties of nanocomposites before and after exposure to the Inductive Core Transformer (ICT) electron beam accelerator. The results obtained were compared with the deviation of their constituents' molecular structure acquired by Fourier Transform Infrared (FTIR) spectroscopy and Keithley 2635A electrical resistivity. The results revealed an enrichment in the mechanical properties of the epoxy matrix after the addition of additives and more performance improvement occurred after irradiation	June 2022	
4	Influence of Electron Accelerator Irradiation on Epoxy Nanocomposite Materials for	Nanocomposite materials and space radiation	Different types of surfactants namely, nonionic, anionic and cationic represented by Polyoxyethylene sorbitan monooleate (Tween 80), sodium dodecyl sulfate (SDS), and cetyltrimethylammonium bromide (CTAB) respectively were used to select a proper type of surfactant enhancing dispersion quality of multiwall carbon nanotubes (MWCNTs) in the epoxy resin. In this study, the effect of electron beams whch are one of the most severe space environment threats. The candidate material proposed in this	2021	https://ajnsa.journals.ekb.eg/article_131992.html

	Spacecraft Structure		study will be used as a structural space material. The candidate material is characterized by furrier transformation infrared spectroscopy (FTIR) so as to identify the mechanical properties, surface tension, and electrical dispersion measurement. The mechanical results revealed that the strength increases by 10% while adding the CTAB surfactant, however, it decreases by 27% and 32% by adding tween-80 and SDS respectively. The anionic surfactant SDS, despite keeping the stiffness, the reference sample is of lower strength and elongation. The CTAB improves the mechanical properties by improving the strength and stiffness while elongation is significantly decreased by adding any of the surfactants. The surface tension of Tween 80 and anionic surfactant SDS, is σ = 24.4 mN/m while the surface tension in the case of the CTAB is σ = 25.4 mN/m. The surface tension and electrical dispersion measurement results reveal that the nonionic surfactant Tween 80 led to a uniform dispersion of MWCNTs in the epoxy than other surfactants. The effect of 100-kGy irradiation via electron beam on the structure and the electrical properties of the epoxy composites was studied. Improving the dispersion quality of the MWCNTs in epoxy nanocomposite materials leads to utilizing these materials in spacecraft structure		
5	Space Environment Effect on Polymeric Nano-Composite Materials	Space radiation and composite materials	Several kinds of polymeric nanocomposites were fabricated by including different typologies of nano-size fillers into a commercial epoxy matrix. The employed additives are multi-walled carbon nanotubes (MWCNTs), alumina (AL2O3) nanoparticles, and three types of graphene platelets (G-CD270, G-33C and G-24N). The effect of the exposition to low earth orbit (LEO) space threats on the candidate nano-composite materials were analyzed by characterization in an ultra-high vacuum (~ 5 × 10–5 Torr), and atomic oxygen (AO) environment (fluence ~ 1.5 × 1021 AO/cm2) in the presence of vacuum ultra-violet (VUV) radiation (intensity peaked at 410 mW/cm2). About outgassing, parameters such as total mass loss (TML), collected volatile condensable materials (CVCM), and water vapor regained (WVR) were measured. Furthermore, the mass loss and erosion rate due to the exposure to the synergic effects of AO and VUV were evaluated. Finally, the various	2021	https://link.springer.com/article/10.1007/s42496-020-00072-0

			specimens were studied by Fourier transmission infrared spectroscopy (FTIR). The experimental findings assess the effectiveness of the proposed nanocomposites for aerospace applications		
6	Enhancement of carbon fiber/epoxy composite electrical, optical and thermal properties by using different types of nano-additives.	Materials and nano additives	Environmental space threats are becoming more critical as they affect the optical, thermal, and electrical properties of the reinforced fiber polymeric-based materials in spacecraft. Three different Nano-particles Alumina (Al_2O_3), Multiwall Carbon Nanotubes (MWCNT), and Reduced Graphene Oxide (RGO) were added to the epoxy matrix and then reinforced by bidirectional carbon fiber plain to form carbon fiber/epoxy by hand lay-up using autoclave curing technique to make three different reinforced materials. In this paper, the electrical, optical, and thermal properties of the carbon fiber/Epoxy Nanocomposite were studied. Fourier transform infrared (FTIR) was performed to evaluate the structural changes in the newly synthesized materials. The optical, thermal, and electrical properties were tested by UV-visible Spectroscopy, Photo-acoustic spectroscopy (PA), and Keithley 2635A respectively. The results showed an enhancement in the electrical, optical, and thermal properties of the epoxy matrix after the addition of Nano-particles. The optical test showed that the neat epoxy and epoxy/Nano-particles absorption spectra were in the infrared range. The thermal test indicated that the three thermal parameters diffusivity, effusivity, and conductivity showed the best enhancement after the addition of MWCNTs. The electrical test pointed out that after the addition of Nano-particles, neat epoxy changed from an insulating material to a semi-conductive material.	2021	https://asat.journals.ekb.eg/article_198202.html
7	Utilization of electric arc furnace dust as a filler for unsaturated polyester resin	Composite materials	Electric Arc Furnace Dust (EAFD) is a waste material produced during the steelmaking process. It contains a large number of valuable metal oxides that can be used as a filling additive to improve the polymer properties. In this study, EAFD is used as a filler for the unsaturated polyester (UP) resin in different weight percentages. Neat UP and UP/EAFD compounds were studied mechanically by testing their tensile, impact, flexural, and hardness properties. The samples were investigated physically by density and water absorption, in addition to flammability analysis was performed by testing the	January 2022	https://www.sciencedirect.com/science/article/abs/pii/S0957582022000891

			Limiting Oxygen Index (LOI). Finally, the thermal properties were determined using Thermogravimetric Analysis (TGA). The result showed that the incorporation of the EAFD particles into the UP matrix has significantly affected the mechanical properties by increasing tensile strength up to 42%. The hardness of the UP/EAFD composites increases up to 8.5% and reaches a maximum value at 10 wt% of EAFD. Flexural strength and impact strength showed an optimal value at 5 wt% of EAFD. The flammability of the composites decreased by 34% at 30 wt% of EAFD. The thermal stability of the composites showed a remarkable increasing trend. Therefore, utilizing EAFD in UP matrix would help improve the environmental pollution control of the steel industry. Finding useful applications of this dust as a filler for the composite industry might convert this hazardous waste into a byproduct that should reduce the expenses and increase their profit.		
8	The Role of Reduced Graphene Oxides in Enhancing the Mechanical Properties of Satellite Structure Nanocomposite Materials against Electron Beam	Composite materials and nano additives	Materials developed for space application to sustain both of mechanical loads ant space environmental threats. The Electron Beam (EB) was selected to represent one of the most hazardous space environment parameter subjected to the Spacecraft (SC) components; the charged particles flux which predicted according to the space mission and its orbit parameters. The candidate materials for this study based on the carbon fiber/epoxy which was enhanced by adding Reduced Graphene Oxide (RGO) and investigate its resistance to EB. RGO addition was varies in three different compounds with different preparation methods; (RGO-24N, RGO-33C and RGO-G270). The RGO additives were dispersed in the epoxy matrix. Each sample was subjected to Integrated Current Transformer (ICT) electron beam at a constant dose of 100 kGy. The mechanical properties of Nano composites were tested by a Universal Testing System (UTS) and were correlated to the variation of their constituents' molecular structure obtained by Fourier Transformation Infrared (FTIR) spectroscopy, Dynamic Mechanical Analysis (DMA) and Electric Resistivity (ER). The results revealed an enhancement in the mechanical properties of epoxy matrix after the addition of RGO except for (RGO-33C) and preservation of the mechanical properties even after irradiation.	2020	https://www.scitechnol.com/peer-review/the-role-of-reduced-graphene-oxides-in-enhancing-the-mechanical-properties-of-satellite-structure-nanocomposite-materials-against--0Qgh.php?article_id=13906

9	Effect of γ-irradiation on the optical and electrical properties of fiber reinforced composites	Composite materials and space radiation	The effect of gamma irradiation on the optical and electrical properties of the reinforced fiber polymeric-based materials became an important issue. Fiberglass/epoxy and Kevlar fiber/epoxy were selected as investigated samples manufactured with hand lay-up without autoclave curing technique. The selected technique is simple and low cost while being rarely used in space materials production. The electric conductivity and dielectric constant for those samples were measured with increasing the gamma radiation dose. Moreover, the absorptivity, band gap and color change were determined. Fourier transform infrared (FTIR) was performed to each of the material's constituents to evaluate the change in the investigated materials due to radiation exposure dose. In this study, the change of electrical properties for both investigated materials showed a slight variation of the test parameters with respect to the gamma dose increase; this variation is placed in the insulators rang. The tested samples showed an insulator stable behavior during the test period. The change of optical properties for both composite specimens showed the maximum absorptivity at the gamma dose 750 kGy. These materials are suitable for structure materials and thermal control for orbital life less than 7 years. In addition, the transparency of epoxy matrix was degraded. However, there is no color change for either Kevlar fiber or fiberglass.	2017	https://www.sciencedirect.com/science/article/abs/pii/S0969806X16304662
10	Outgassing Effect on Spacecraft Structure Materials	Composite materials in space environment	In the vacuum deep space, outgassing has contributed to degrade the mechanical performance of composite materials used in satellite. In this paper, four composite materials are used. Three types of epoxy based composite materials are tested: Carbon fiber, glass fiber and kevlar, which are used in satellite structures. The tested materials are manufactured by commercial method (hand lay-up method without autoclave curing). The fourth material is polyimide which is a commercial sheet used in thermal multilayer insulators. The aim of this paper is to qualify those commercial manufacturing materials to be used as Low Earth Orbit satellite structures. This study proves two important results; the use of hand lay-up Kevlar/epoxy in the satellite manufacture is rejected. While the commercial Polyimide (Artilon®) is	2015	https://www.researchgate.net/publication/312198021_Outgassing_Effect_on_Spacecraft_Structure_Materials

			confirmed as a new material used in space as a layer in the multilayer insulation at the lower temperature side.		
11	Performance Evaluation of Selected Irradiated Space Structure Composites Manufactured by the Hand Lay-Up Method	Composite materials and space radiation	Polymeric composites are widely used in manufacturing the space structures because of their superior light weight compared with either the metallic ferrous or non-ferrous materials. These materials should secure high strength to weight ratio and reasonable thermal and/or optical properties. In this work, the selected polymeric matrix composites reinforced with three different types of fibers, namely, carbon, fiberglass, and Kevlar were manufactured with the low-cost hand lay-up method. These samples were irradiated with different doses of γ-rays. These prescribed doses were chosen to simulate the charged particles space hazards in a well-defined orbit for 3.75, 5.625, and 7.5 years. Gases trapped during the manufacturing process were extracted and analyzed using the vacuum simulator facility at relatively high temperature to evaluate their effect on the optical surfaces. Mechanical properties variation of the irradiated composites was traced by tensile testing and correlated to the variation of their constituents' molecular structure which was analyzed by the Fourier Transformation Infrared (FTIR) spectroscopy. Thermal stability of the constituents of the irradiated composite, with the previously prescribed doses, was monitored at a wide range of temperatures	2018	https://doi.org/10.15866/irease.v11i4.13726
12	Influence of Simulated Space Hazards on Polyimide Artilon TM Type Used in Space Applications	Composite materials and space radiation	The polyimide performance was monitored and evaluated after exposure to ionized and particulate radiation as a space hazard. The material was irradiated with three different doses 500, 750 and 1000kGy in CO60 source in the presence of air. Both non-irradiated and irradiated materials were characterized by tensile test, Thermo-Gravimetric Analysis (TGA) and Fourier Transform Infra-Red (FTIR). Quantum modeling was executed by using "Gaussian 5" software program for chemical structure verification. The non-irradiated material showed a super ductility but revealed a brittle behavior when irradiated with 500 and 1000 kGy gamma doses. Nevertheless, the material attained moderate ductility when exposed to 750kGy. Results by the stated characterization tools matched with the evaluated behavior and confirmed by the quantum modeling	2016	https://www.praiseworthyprize.org/jsm/index.php?journal=irease&page=article&op=view&path%5B%5D=19422