Carbon-red mud foam/paraffin hybrid materials for thermal energy storage and electromagnetic interference shielding applications

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Carbon-based porous materials are very promising candidates for Phase Change Materials (PCMs) shape stabilizers, because of their higher thermal conductivities when compared to the polymers or ceramic analogs. Also, their synthesis is not complex but more importantly requires low cost and abundant raw materials. In this work, host carbon-based porous foams matrices were synthesized utilizing the polymeric foam replication method. Green floral foam (phenol-formaldehyde foam) was used as a template, phenolic resin was used as a carbon source, while red mud was used as a filler. For this purpose a chemical and morphological investigation of the structure was carried out, along with the investigation of its porosity and mechanical properties. Carbon-red mud foam hybrid materials indeed exhibit open-cell structures with high porosity (>65%), with inorganic walls composed of various ceramic phases and partially graphitized carbon. The paraffins that were used as PCMs were n-octadecane, and the commercial RT18HC. After the incorporation, several spectroscopic and analytical techniques were used to obtain the paraffin loading and the thermal stability of the hybrid materials. Leaching tests of the hybrids indicated that the carbon foams can absorb and retain large PCM amounts, with adequate encapsulation efficiencies, whereas the investigated hybrids show also efficient electromagnetic shielding performance required for commercial applications. Their excellent thermal and EMI shielding performance, make the as-prepared samples promising candidates for use in thermal management and EMI shielding of electronic devices.

References

Christina Gioti, Anastasios Karakassides, Georgios Asimakopoulos, Maria Baikousi, Constantinos E. Salmas, Zacharias Viskadourakis, George Kenanakis and Michael A. Karakassides, Multifunctional Carbon-Based Hybrid Foams for Shape-Stabilization of Phase Change Materials, Thermal Energy Storage, and Electromagnetic Interference Shielding Functions**,** micro (2022) in press.

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