ABSTRACT

The energy demand for the current society calls for reliable and sustainable energy resources. Solar energy is one such source with availability in abundance worldwide. Also, the recovery of energy lost in the form of waste heat is a means of securing energy sustainability by minimizing losses. Organic solar cells (OSCs) are relevant in solar energy harvesting while thermoelectric power generators (TEGs) are used in recycling waste heat. These devices require functional materials for effective performance. Graphene, because of its outstanding properties, is suited for applications in OSCs and TEGs. It is suitable as an active and interfacial layer material in polymer solar cells; a counter electrode and photoanode additive material in dye sensitized solar cells; interfacial layer material and active layer additive in perovskite solar cells. In these solar cells, graphene mainly aids charge transport thus, improving the energy conversion efficiency. As a thermoelectric material, graphene is limited by its high thermal conductivity and lack of energy band gap which causes a low Seebeck coefficient. But by graphene doping, nanostructuring and structural defects, the thermal conductivity is reduced and the thermopower is increased to improve the ZT. Also, inclusion of graphene in thermoelectric nanocomposites greatly improves the thermal to electric energy conversion efficiency.