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Smart cord-rubber composites with integrated sensing capabilities by localised carbon nanotubes using a simple swelling and infusion method

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Abstract: Smart self-sensing composites with integrated damage detection capabilities are of particular interests in various applications ranging from aerospace and automotive structural components, to wearable electronics and healthcare devices. Here, we demonstrate a feasible strategy to introduce and localise conductive nanofillers into existing elastomeric coatings of reinforcing cords for interfacial damage detection in cord-rubber composites. A simple swelling and infusion method was developed to incorporate carbon nanotubes (CNTs) into the elastomeric adhesive coating of glass cords. Conductive CNT-infused glass cords with good self-sensing functions were achieved without affecting the bonding provided by the coating with rubber matrix. The effectiveness of using these smart cords as interfacial strain and damage sensors in cord-rubber composites was demonstrated under static and cyclic loading. It showed the possibility to identify both reversible deformation and irreversible interfacial damage. The simplicity of the proposed swelling and infusion methodology provides great potential for large-scale industrial production or modification of CNT functionalised elastomeric products such as cord-rubber composites.

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