

Electrical resistance measurements for health monitoring in composite materials

George Georgoussis

Abstract

The scope of this thesis is to study the health monitoring of a material under mechanical load by measuring the change of its electrical conductivity.

The matrix of the materials which were tested was either polyether-ether-ketone (PEEK) or polypropylene (PP), while the inclusion was either carbon fibers or carbon nanotubes. Each sample was being put under tensile strain until its breakage while measuring the stress, strain, and its electrical resistivity simultaneously. Both the longitudinal and the through thickness electrical resistivities of the samples reinforced with carbon fibers were measured. Cyclic loading experiments took place, as well.

The results were encouraging as far as the credibility of this method is concerned, namely taking a reliable sense of the damage of a material by measuring its electrical resistivity. Moreover, some additional conclusions came up on how each material differs from the others concerning their electrical and mechanical behavior.

Keywords

polyether-ether-ketone, PEEK, materials with fibers, carbon fibers, CF, carbon nanotubes, CNT, MWCNT, polypropylene, PP, electrical resistance, electrical conductivity, health monitoring, damage, damage sensing, damage evaluation, composite materials, composites, nanocomposites, nanocomposite materials, stress, strain, tensile strain, cyclic loading