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Electrical impedance spectroscopy for measuring the impedance response of carbon-fiber-reinforced polymer composite laminates

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Abstract

Techniques that monitor the change in the electrical properties of materials are promising for both non-destructive testing and structural health monitoring of carbon-fiber-reinforced polymers (CFRPs). However, achieving reliable monitoring using these techniques requires an in-depth understanding of the impedance response of these materials when subjected to an alternating electrical excitation, information that is only partially available in the literature. In this work, we investigate the electrical impedance spectroscopy response at various frequencies of laminates chosen to be representative of classical layups employed in composite structures. We clarify the relationship between the frequency of the electrical current, the conductivity of the surface ply and the probing depth for different CFRP configurations for more efficient electrical signal-based inspections. We also investigate the effect of the amplitude of the input signal.

Keywords: CFRP composites, Electrical impedance spectroscopy, Non-destructive testing, Electrical measurements.

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